Heating Piping & Air Conditioning

AUGUST 1959

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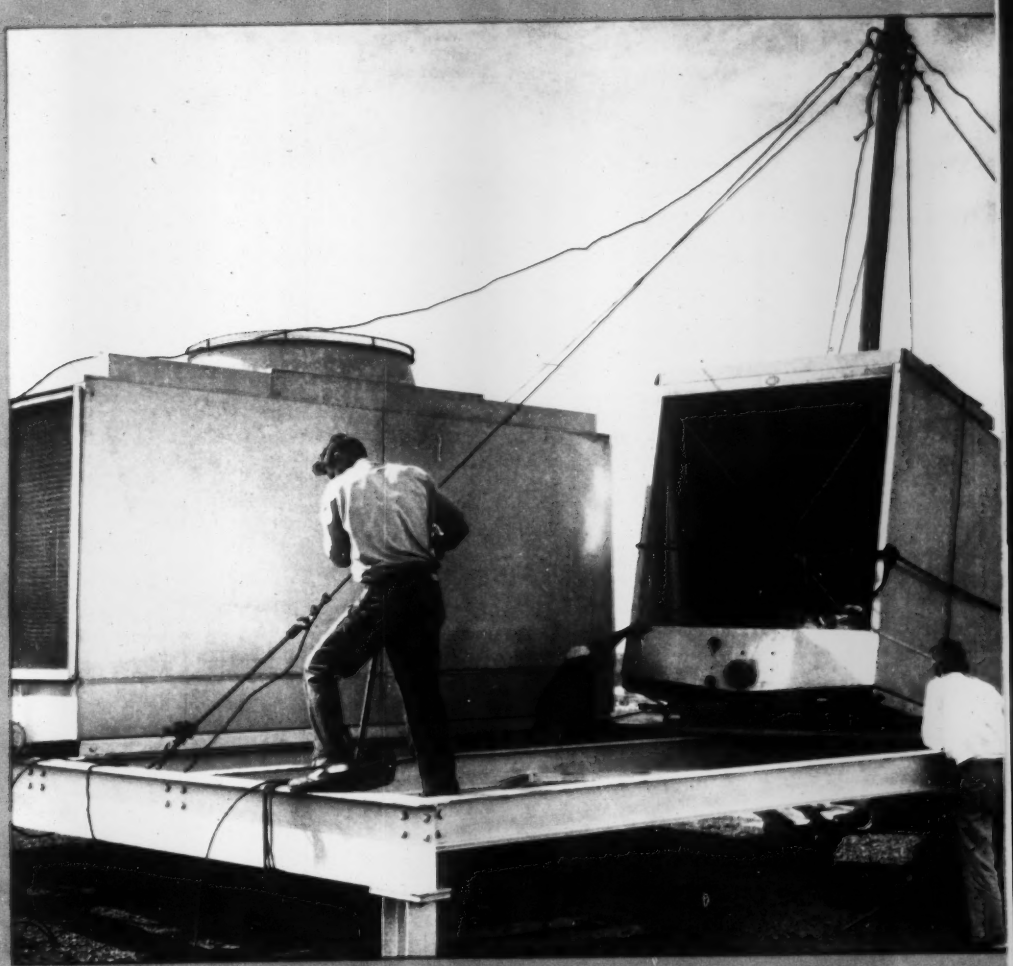

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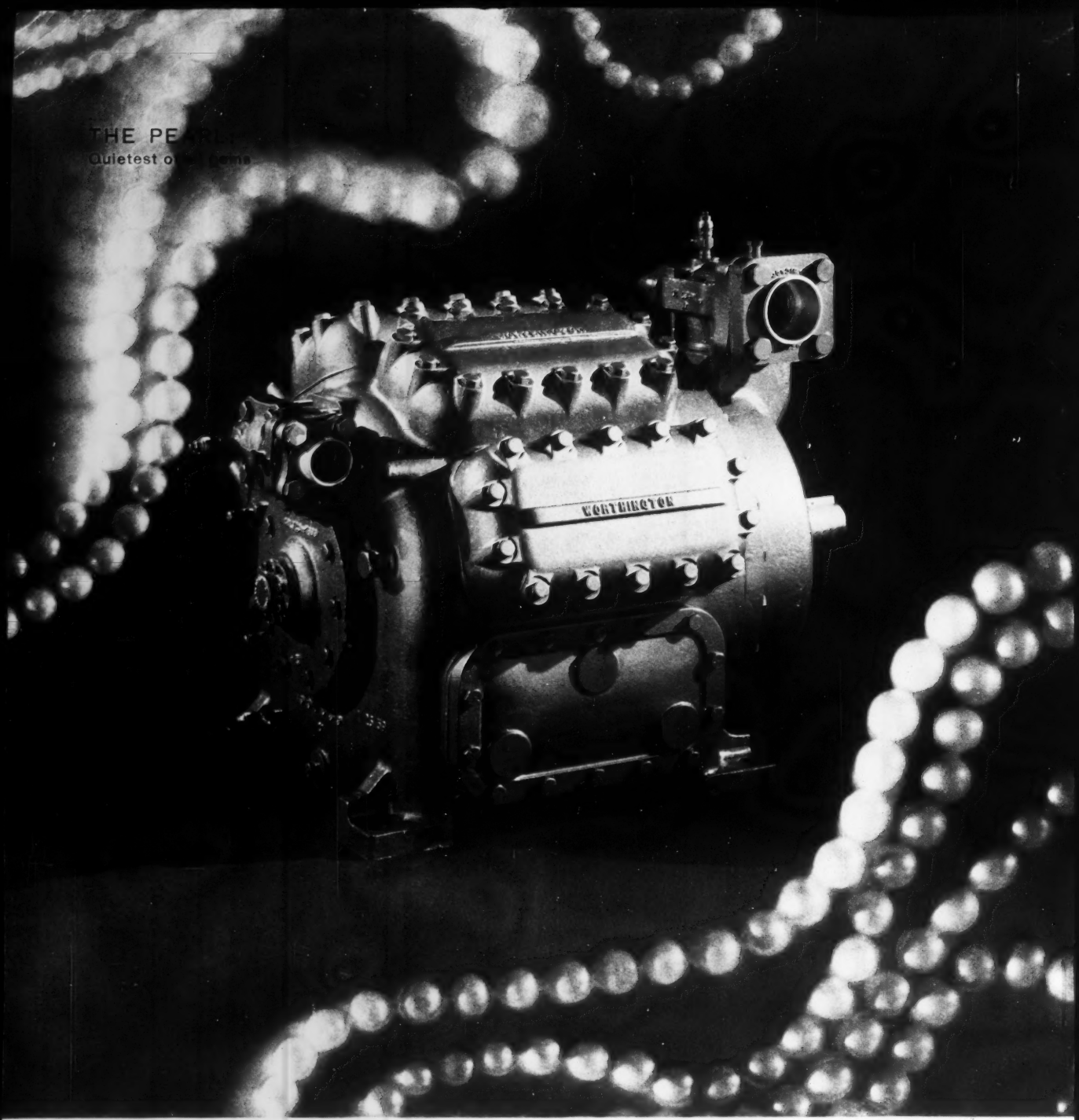

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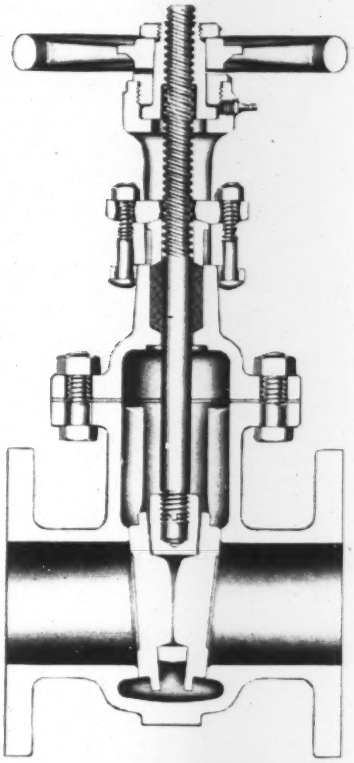
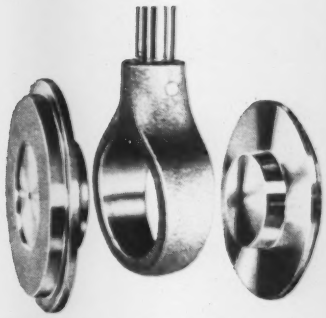
You have to listen carefully to hear this refrigeration compressor run . . . so quietly does it operate. Exceptionally close tolerances and use of cushioned ring valves with hydraulic unloading make possible this whisper-soft operation. Available in two types: a field-serviceable hermetic compressor and a coupled compressor arrangement. All compressor parts are interchangeable between the two units. No wonder we call it a jewel of great value. Worthington Corp., Ampere Sta., East Orange, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ont.

WORTHINGTON

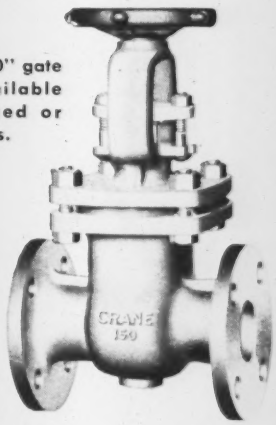


Sizes ½" to 12"; 150 psi at 500 F, 230 psi at 100 F



Crane split-wedge disc design. Identical disc halves assure uniform seating pressure.

"Craneloy 20" gate valve. Available with flanged or screwed ends.



Exclusive design for lasting tight seating in "Craneloy 20" gate valves

The simple, unique split-wedge disc construction in "Craneloy 20" gate valves is the key to smooth operation, tight shutoff and long seat life.

Identical disc halves, exclusive with Crane, mean that seating loads are transmitted equally to each half, assuring uniform pressure on the seating faces. No danger of buckling—there's no weak disc member as in conventional ball and socket disc construction. In opening, the first turn of the handwheel frees discs—even if the valve is closed hot and opened cold.

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All parts of the valve in contact with flow are "Craneloy 20," a high nickel, high chromium stainless steel cast in Crane's own foundries. Stuffing boxes are packed with tough, resilient, non-contaminating Teflon.

For complete information about all Crane stainless steel valves, see your Crane Representative.

Get complete specifications on "Craneloy 20" stainless steel valves. Ask your Crane Representative for Circular AD-2080, or write to address below.

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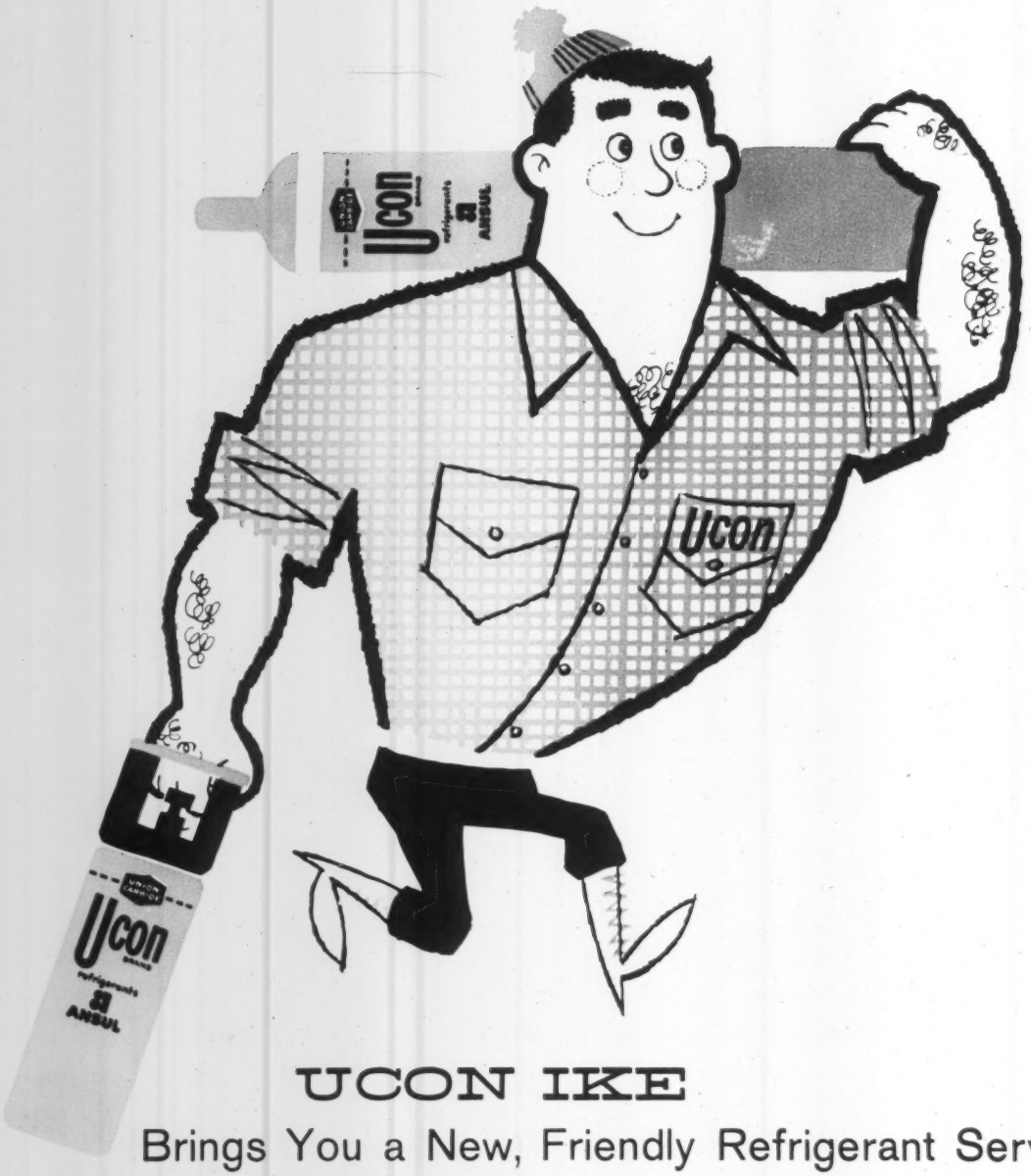

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Heating Piping & Air Conditioning

Vol. 31, No. 8

August 1959

(With which is merged the Aerologist)

for CONSULTING ENGINEERS, MECHANICAL (heating, piping, and air conditioning) CONTRACTORS, and ENGINEERS WITH PLANTS AND BIG BUILDINGS

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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $5.00 per year; Canada, $5.00 per year; Cuba, Mexico, Central America, South America, Spain, $6.00 per year; other, $7.00. Current copies, 75c each; back copies, $1.00 each. January 1959 issue $2.00 per copy. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms. ©1959 by the Keeney Publishing Co. SECOND-CLASS POSTAGE PAID AT CHICAGO AND MENDOTA, ILL.

SUBSCRIBERS—*Change of Address*: Publisher needs two weeks' advance notice; mail address from current issue envelope, and new address with city postal zone number. Mail to . . . Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., U. S. A.

POSTMASTER: *If undelivered Magazine is undeliverable*, Send Form 3579 to Publisher at above address. Include city postal zone AND DATE *on last line* under mail address on envelope as our *key*.

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How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

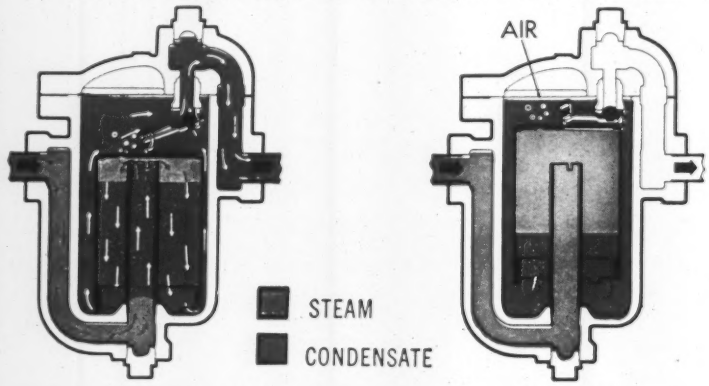
By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works
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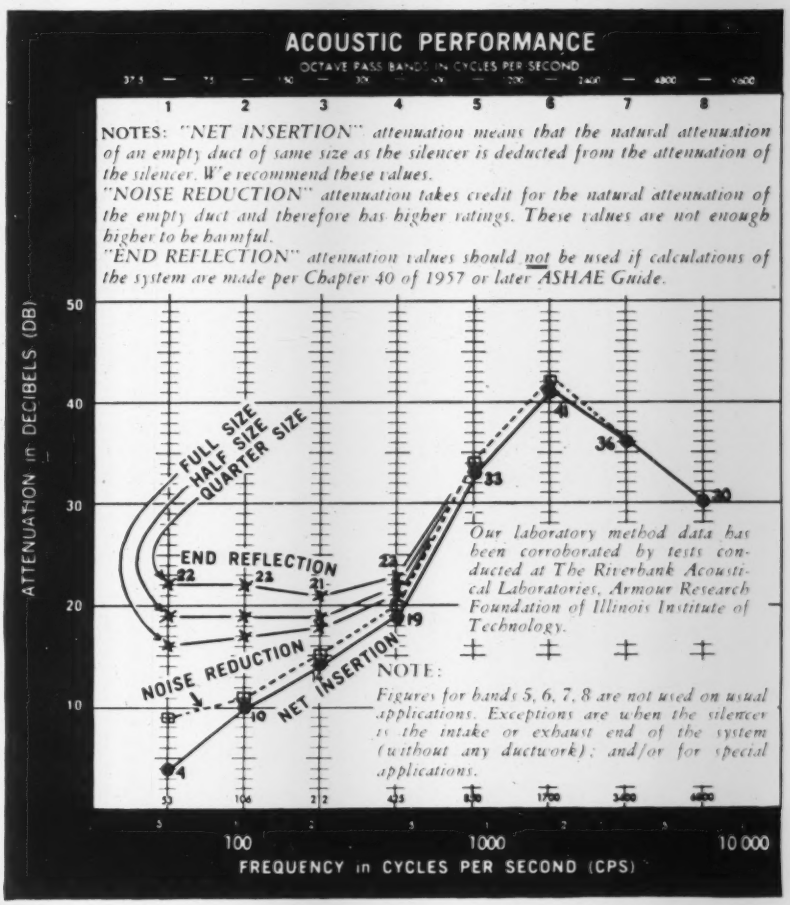
ARMSTRONG STEAM TRAPS

MOD-U-SIZE Silencers

Trade Mark

are the silencers you use **rated** properly?


ACOUSTIC PERFORMANCE
OCTAVE PASS BANDS IN CYCLES PER SECOND
1 2 3 4 5 6 7 8
NOTES: "NET INSERTION" attenuation means that the natural attenuation of an empty duct of same size as the silencer is deducted from the attenuation of the silencer. We recommend these values.
"NOISE REDUCTION" attenuation takes credit for the natural attenuation of the empty duct and therefore has higher ratings. These values are not enough higher to be harmful.
"END REFLECTION" attenuation values should not be used if calculations of the system are made per Chapter 40 of 1957 or later ASHAE Guide.
ATTENUATION in DECIBELS (DB)
50
40
30
20
10
FULL SIZE
HALF SIZE
QUARTER SIZE
END REFLECTION
NOISE REDUCTION
NET INSERTION
22
23
21
19
33
41
36
30
4
10
Our laboratory method data has been corroborated by tests conducted at The Riverbank Acoustical Laboratories, Armour Research Foundation of Illinois Institute of Technology.
NOTE:
Figures for bands 5, 6, 7, 8 are not used on usual applications. Exceptions are when the silencer is the intake or exhaust end of the system (without any ductwork); and/or for special applications.
100
1000
10 000
FREQUENCY in CYCLES PER SECOND (CPS)

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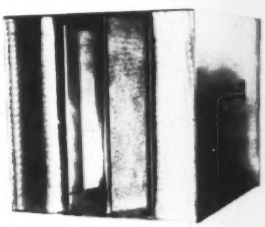

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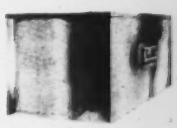

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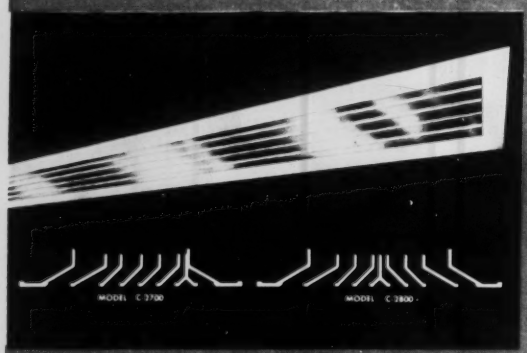

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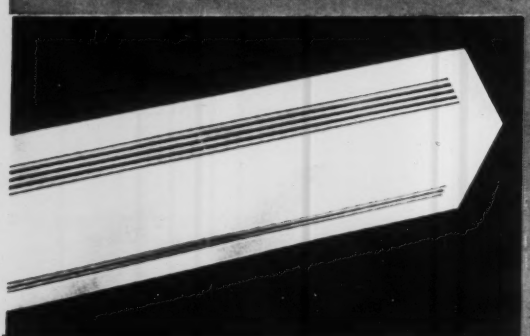
*PICTURED ABOVE: Titus Series C-2500 Linear Type grille for sidewalls.



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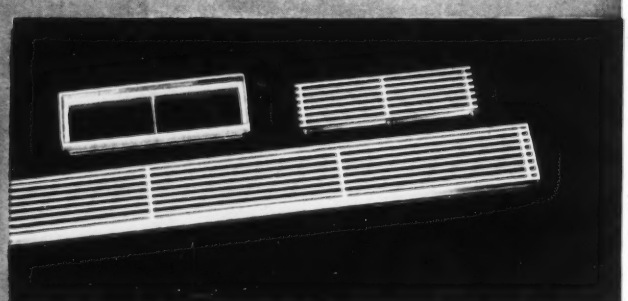

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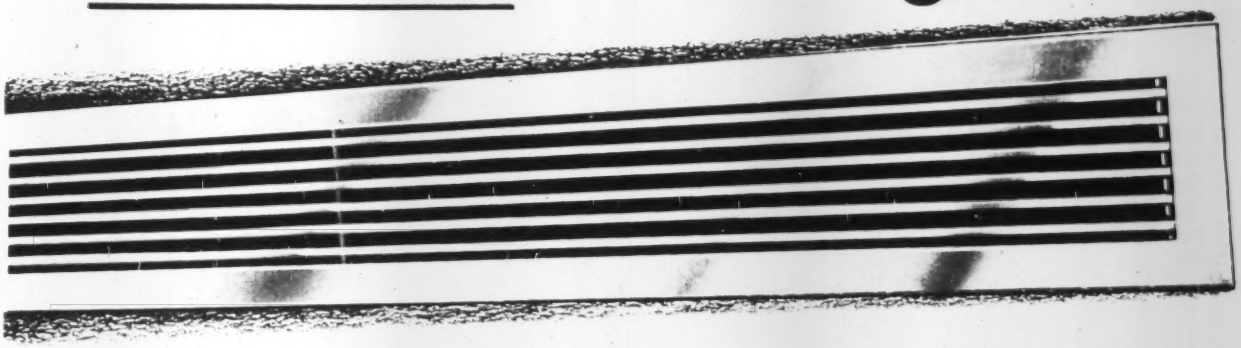

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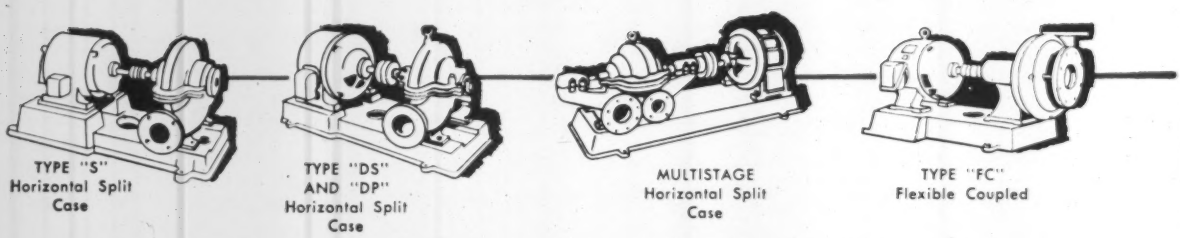

TYPE "S" Horizontal Split Case

TYPE "DS" AND "DP" Horizontal Split Case

MULTISTAGE Horizontal Split Case

TYPE "FC" Flexible Coupled

"from Chicago"

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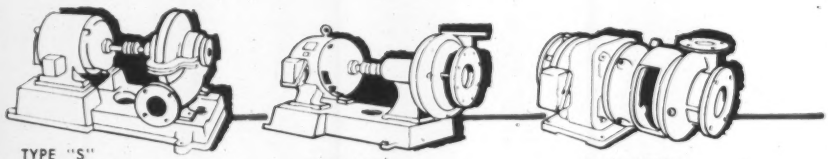
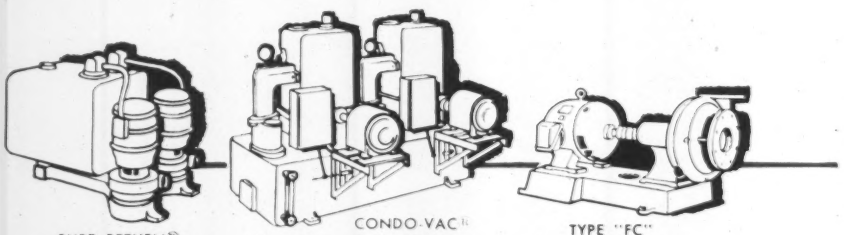


TYPE "S" Horizontal Split Case

TYPE "FC" Flexible Coupled

TYPE "CC" Close Coupled



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CONDO-VAC® Boiler Feed & Vacuum

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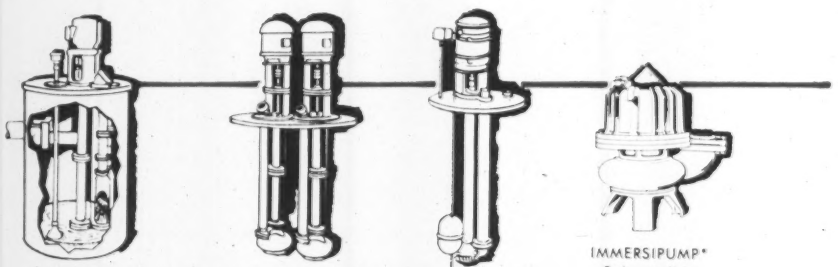

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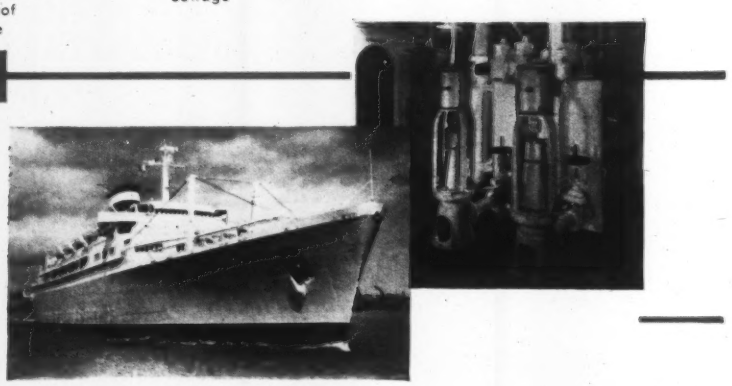
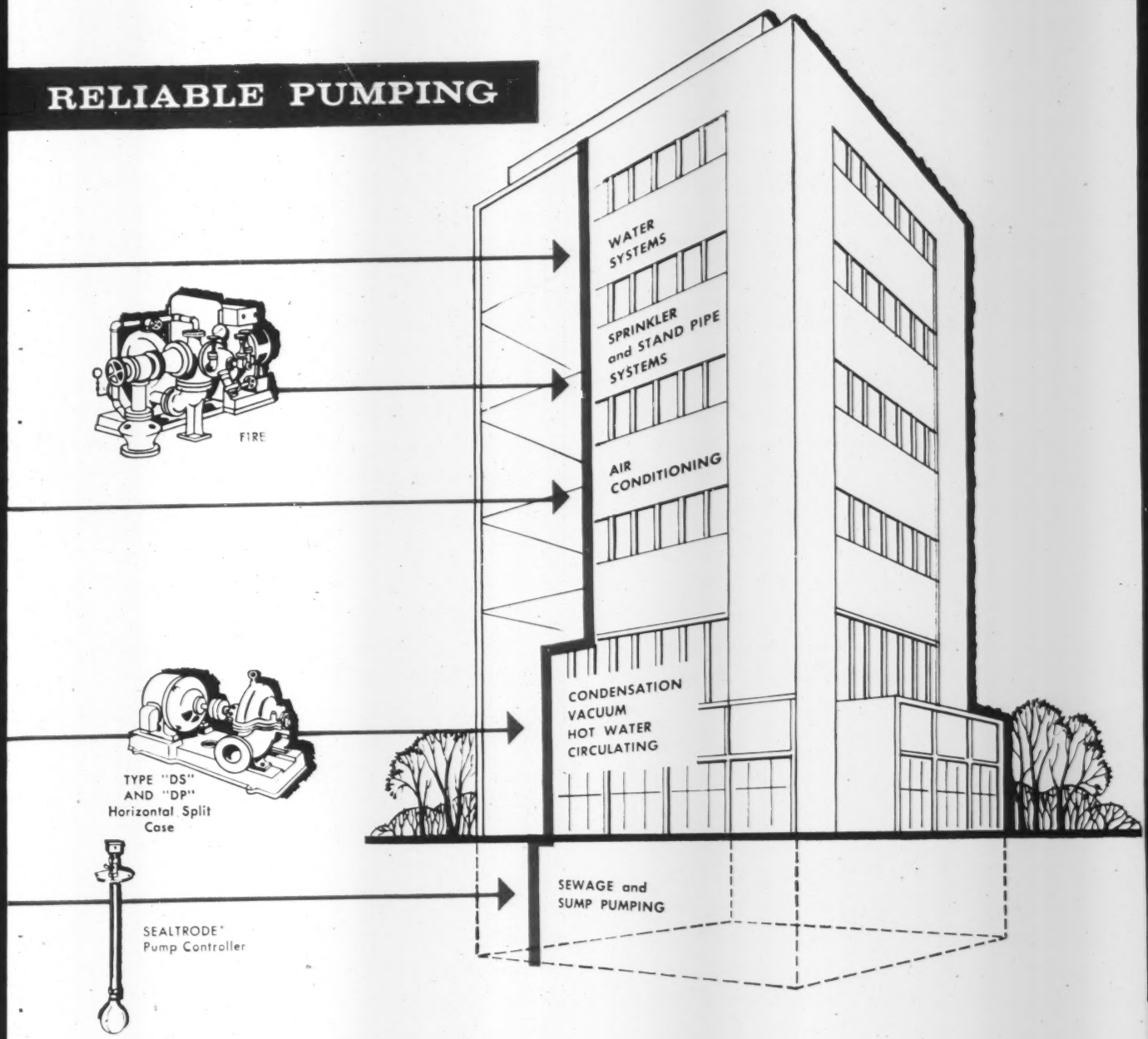


"Chicago" FLUSH KLEEN® Clog-Proof Sewage Pumps aboard the S. S. Santa Paula

RELIABLE PUMPING



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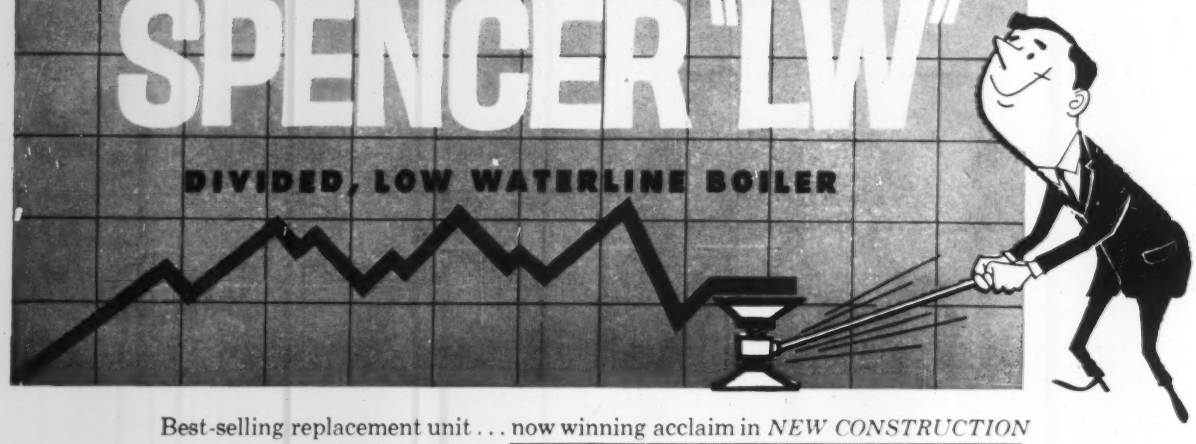

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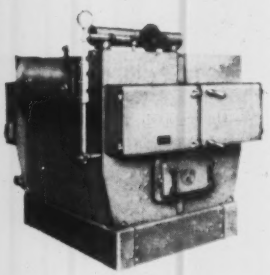

LOWER WATERLINE

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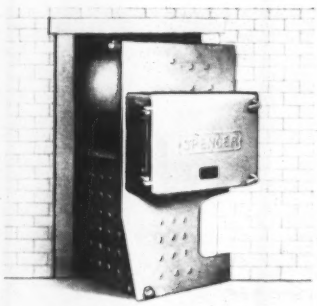

Plus Spencer "LW" features a full *5" waterleg* for fast-steaming, heat-saving, efficient operation. The "LW" is available in a complete range of sizes: from 2,200 to 42,500 sq. ft. steam SBI ratings.

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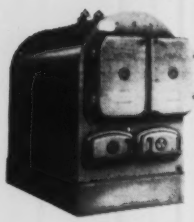

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LETTER FROM THE EDITOR

August 1959

Dear Reader:

The analysis for determining the type of air conditioning system to be used in the 33-year-old, 11-story Livestock Exchange office building in Omaha is presented on pages 85 to 87. The author is R. G. Hurstad, the mechanical contractor for the installation. Cost estimates of three proposed methods led to the decision to use packaged units -- in this particular case -- to completely air condition the building. The owner required that the installation be made in three stages and that the equipment take up no rentable floor space. How this system was able to meet these requirements is discussed in this article. There are many methods that can be used to air condition a building. Choice of the correct one for any job must always be based on an engineering analysis.

High temperature hot water heating was selected for serving the new Everett high school in Lansing, Mich., after weighing very carefully the advantages and disadvantages of many types of systems. One of the main reasons the author of this article, Anton Krapek, consulting engineer, decided on HTHW was that it solved the problems posed by the structure's large size and boiler room location. The article is on pages 88 and 89. Several heating methods are used in various parts of the building -- including unit ventilators, convectors, and built-up heating and ventilating units -- all supplied by HTHW.

The acceptance of the heat pump is growing as a means for providing year 'round air conditioning in large buildings, according to E. R. Ambrose in his talk before the recent convention of the Mechanical Contractors Association in Washington, D.C. A report of his talk is on pages 90 to 93; he describes the basic types of heat pump cycles and presents design and operating data for several installations.

The design considerations for piping liquefied gases (cryogenics) was discussed in a conference session at the recent meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers and is reported on pages 94 and 95. In the last 10 years, this field has grown to a multi-million dollar industry and the application of liquefied gases is branching into the missile and rocket propulsion fields, thermonuclear power plants, transportation of natural gas and many others. The properties of piping materials are radically different in the low temperature range of -250 to -460 F and therefore special care must be devoted to the design and installation of these systems. Also, piping insulation requirements are naturally very different.

The design of any fuel oil piping distribution system depends on a number of factors which came up in England recently at one of the government housing projects. The author of the article in which these experiences are related (pages 96-99) is John W. McKay. He points out that the amount of basic design information for these systems is limited, but from these studies they found that horizontal runs of the piping system should be limited to 100 ft, that the vertical lift in the piping system should be limited to 10 ft, and that all pipe joints must be tight and leakproof. In addition to this, a fuel oil transfer pump should be provided to operate continuously to keep the suction and return mains flooded. Fuel oil piping systems incorporating these provisions will be designed correctly, according to Mr. McKay.

Proper inplant environment is essential to worker comfort and product quality. That was the theme of the industrial ventilation conference held at the ASHRAE meeting. A report of the four speakers' presentations is given on pages 102 through 104. Included in the subjects discussed are the general design requirements of industrial ventilation systems for modern industry, the increasing importance of dust and fume control, and the use of shielding to reduce the radiant heat emitted from hot plant equipment and processes.

To air condition Detroit's Henry Ford hospital, it was necessary to drill 2550 holes through 6 in. reinforced concrete floors. How this was done without disturbing the patients with noise is described by R. Lester Spitzley and W. A. Brown in their article on pages 108 and 109. The job was completed quickly, neatly, and with a minimum interruption of hospital operations through careful planning and the use of a portable drilling machine with diamond drill bits.

A new flame failure protection system installed at the United States Military Academy utilizes the principle of changing the auxiliaries over to steam operation in the event of a power failure. This is done before the steam head on the boilers is lost and without extinguishing the fire. The design of this flame failure protection system was complicated because it had to provide for continuous operation even when a power failure occurred. Melvin H. Friedman discusses the design considerations involved and how the system operates in his article on pages 110 and 111.

Fundamentals of water treatment for preventing scale deposit and corrosion damage in air conditioning systems are detailed by J. L. Thornley on pages 112 through 115. He points out how water can dissolve solids and eventually deposit them as scale in water cooled air conditioning systems. This formation, of course, can impede heat transfer, restrict water flow, and cause corrosion. He says the pH value of the water should be maintained in the neutral range of 6.5 to 7.5. However, the control of pH alone is not a sufficient corrosion preventive. Inhibitors must be used in most cases.

How to join and support refrigerant piping is discussed by W. C. Smith on pages 116 through 118. He points out that tightness and strength of the joints are musts for all types of refrigerant piping systems. Welded and brazed joints provide the most positive type of seal, but because of cost and permanency, this type of joint may not always be feasible. It is important that the supports for these piping systems, as well as the entire system, be designed in accordance with local codes and the Code for Pressure Piping, ASA B31.1.

Controlling industrial ventilation systems in which 100 percent outdoor air is admitted is discussed by C. James Busch in his article on pages 119 through 122.

What to consider when selecting cocks and plug valves is the subject of the HPAC Engineering Data File on pages 123 through 134. Cocks and plug valves (which evolved from cocks), are made in a number of different designs. Of course, plug valves have many characteristics that are not available in cocks. These differences are primarily related to the pressure-temperature ratings of plug valves, which are higher than those for cocks. This report considers the selection of general types of cocks and both lubricated and non-lubricated plug valves. Several factors that must be considered when selecting these valves are discussed. The report also explains how these valves operate, where they are used, and what lubrication should be applied to the various types of lubricated valves.

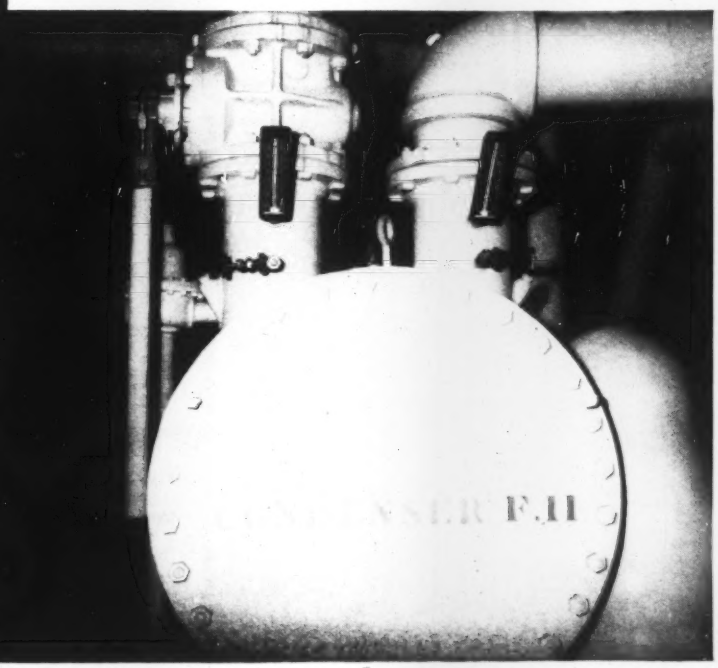
The You'll Want to Know news reports are on pages 39 to 46 this month and "Open for Discussion" is on pages 73 through 76. The HPAC Data Sheet (pages 105 and 106) contains more steam pipe sizing data, and The Law and Your Profits is on page 107 this month. Several case histories from a consulting engineer's files (C. T. Baker) are given on pages 100 and 101.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

HOW TO GET PERFECT BALANCE ON CHILLED WATER LINES

and throttle or shut-off with one valve



Rockwell-Nordstrom fig. 143, 200 lb. valves on chilled water circulation system at 300,000 sq. ft. fully air conditioned manufacturing plant in Texas.

More and more air conditioning designers are relying on Rockwell-Nordstrom lubricated plug valves for perfect, one-valve control of chilled water systems. On any size line, these *lubricated* valves will give you design and operating advantages that you can't expect from ordinary valves. A few of these advantages are shown below. For details, write for literature; or better yet, talk to a Rockwell field engineer.

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2. *Throttle Shut-Off:* Pressurized *lubricant* sealing that can't "wear out," plus unexposed seating, assure positive shut-off. Seats never exposed to line, eliminating main cause of throttle valve failure.
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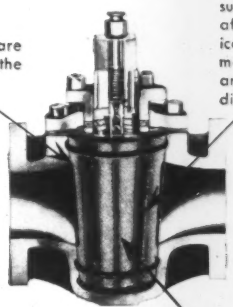
4. *Compact:* No bonnet cavities or rising stem member . . . saves weight, space.
5. *Sizes To 36":* Chill water lines above 8" are no longer a problem, you get size and pressure rating you need to meet your design requirements.



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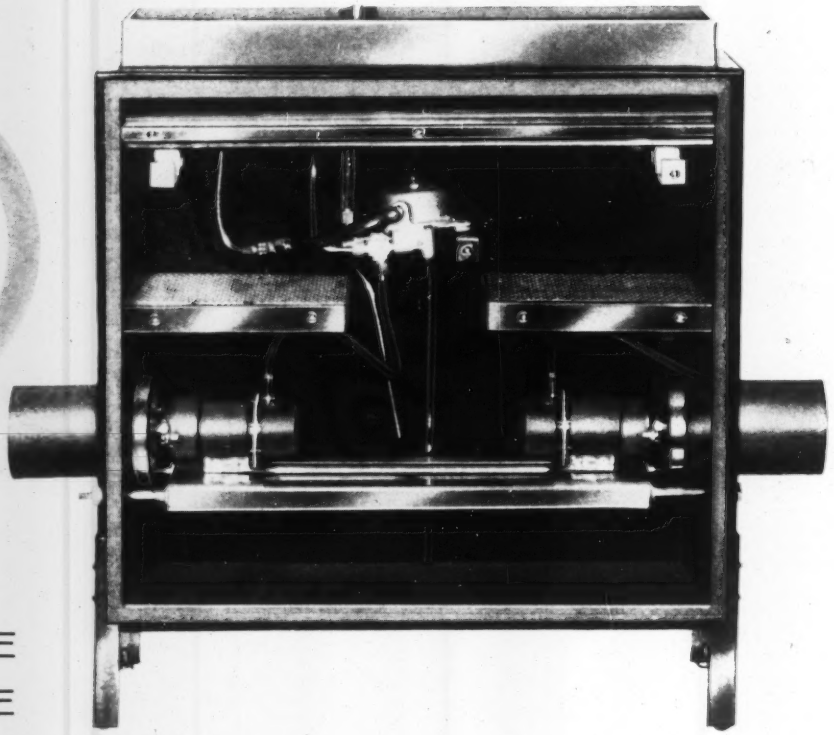

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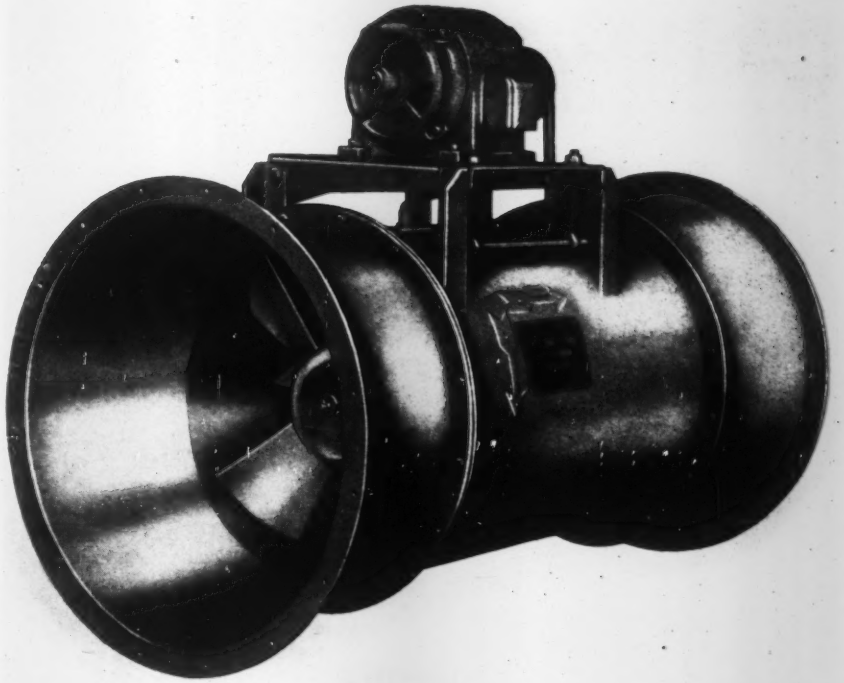

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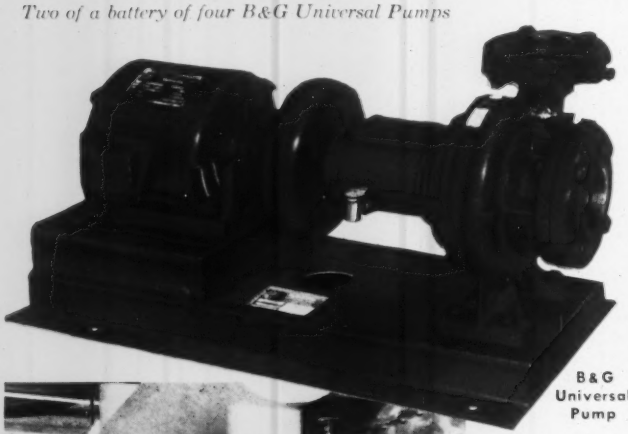
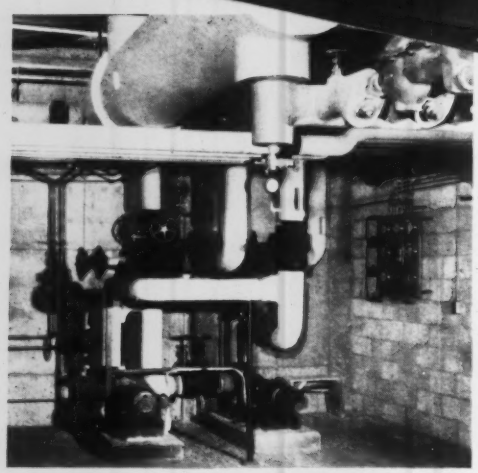


B&G Universal Pump



Remaining two B&G Universals; above them is a B&G Type "SU" Heat Exchanger.

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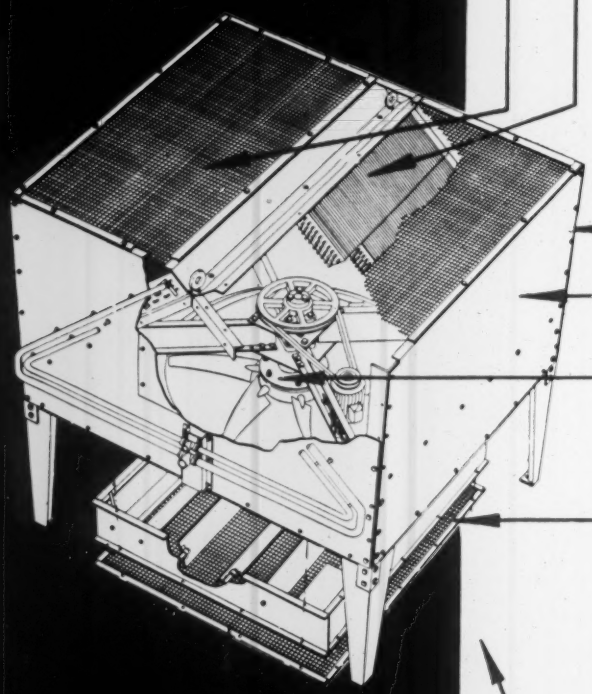

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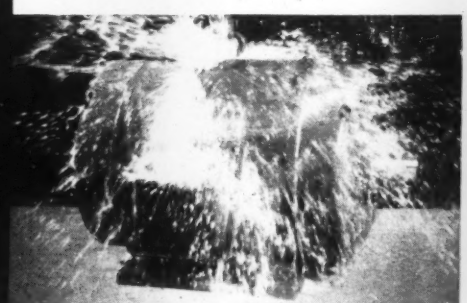

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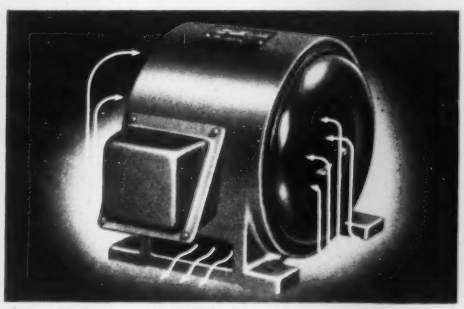

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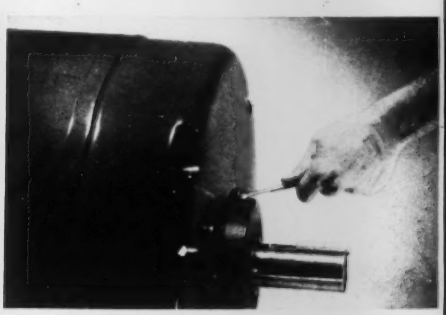

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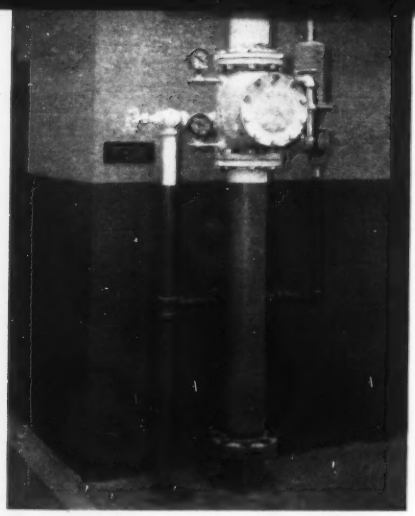

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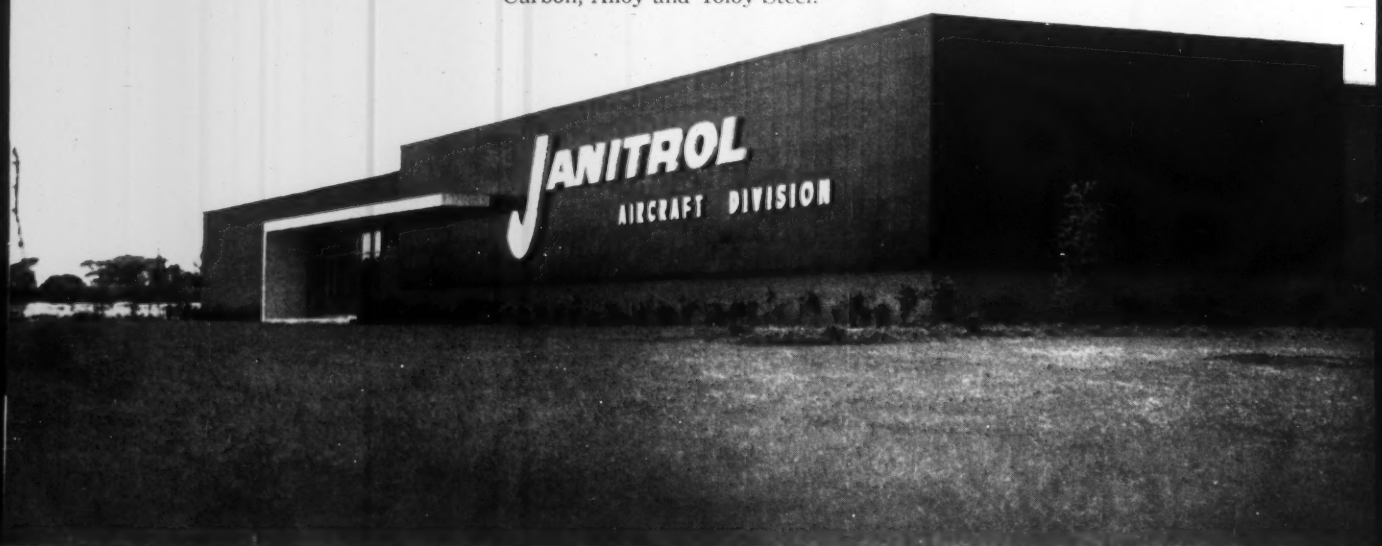

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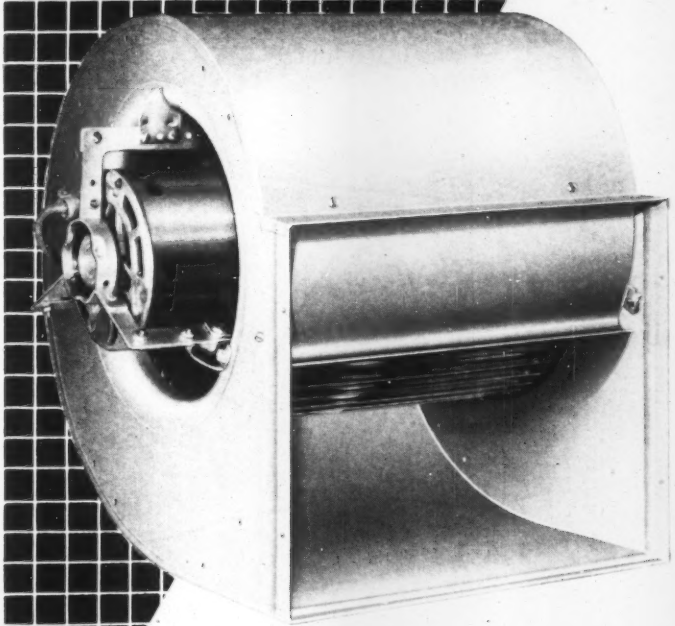

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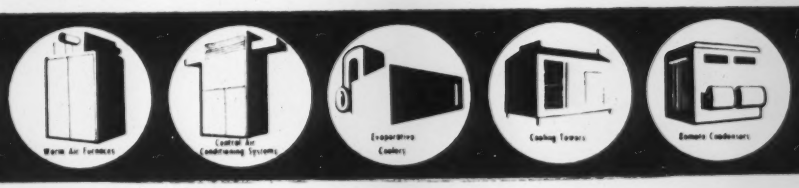

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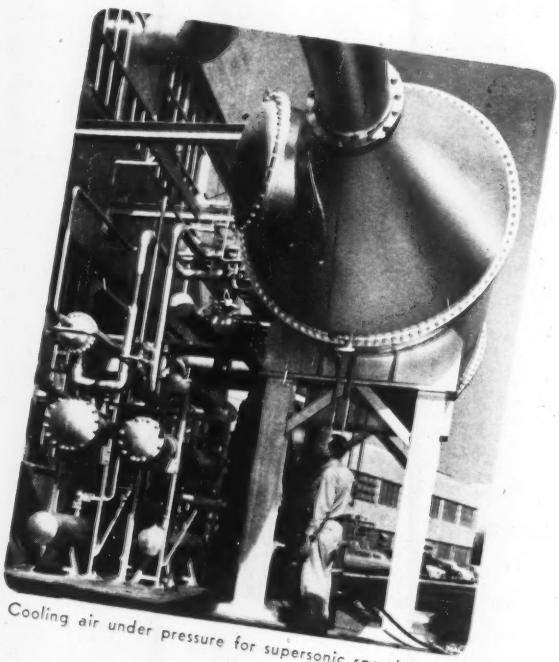
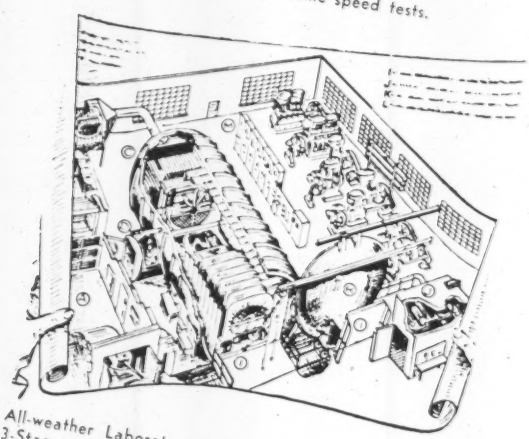
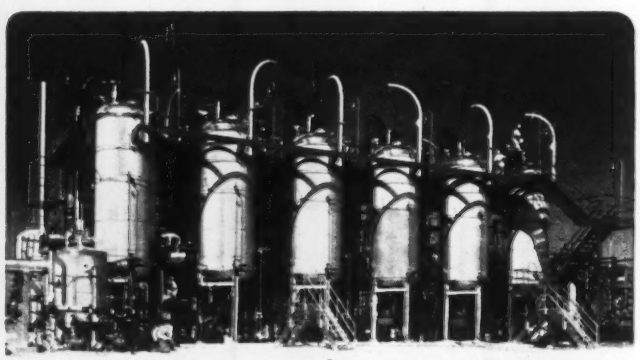


Cooling air under pressure for supersonic speed tests.



All-weather Laboratory built for U. S. Army. Uses 3-Stage compressors; maintains Arctic, tropic and stratospheric conditions.



Frick patented cooling coils and controls have doubled the output of synthetic rubber reactors.

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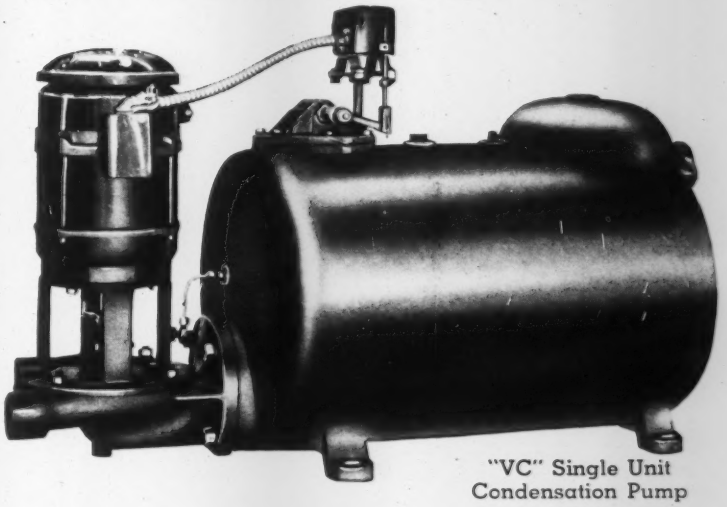

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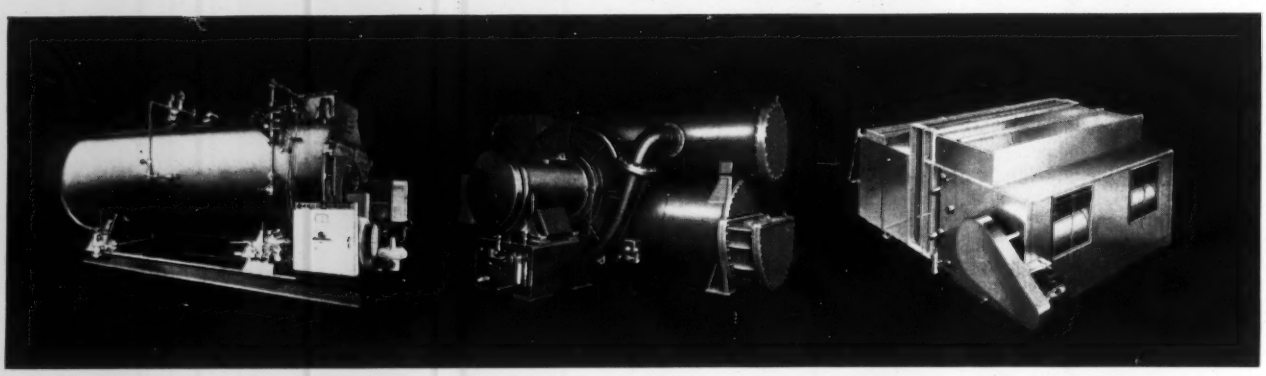

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Centrifugal refrigerating machines for central-station air-conditioning systems.

Central-station air-conditioning units for public buildings, industrial plants.

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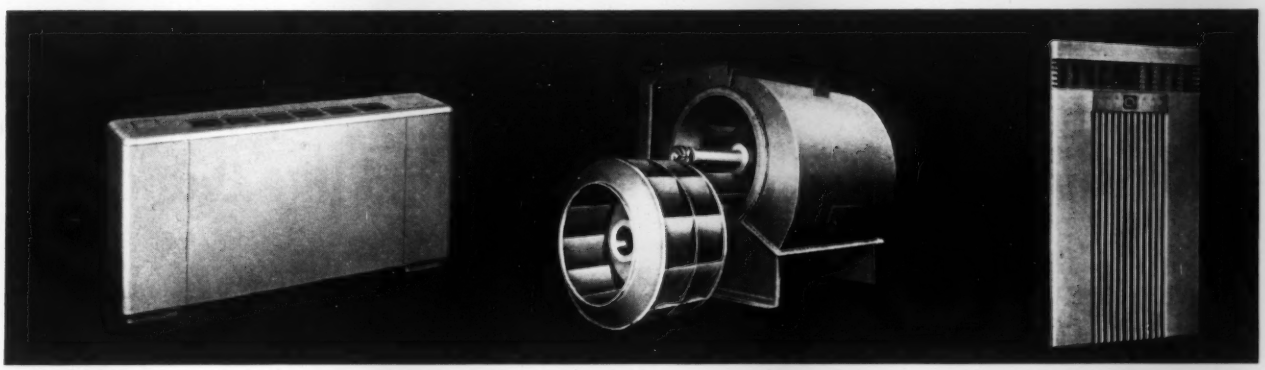

Fancoil units for cooling and heating individual rooms in multi-room structures.

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Packaged commercial air conditioners, air- or water-cooled types, 3 to 20 tons.

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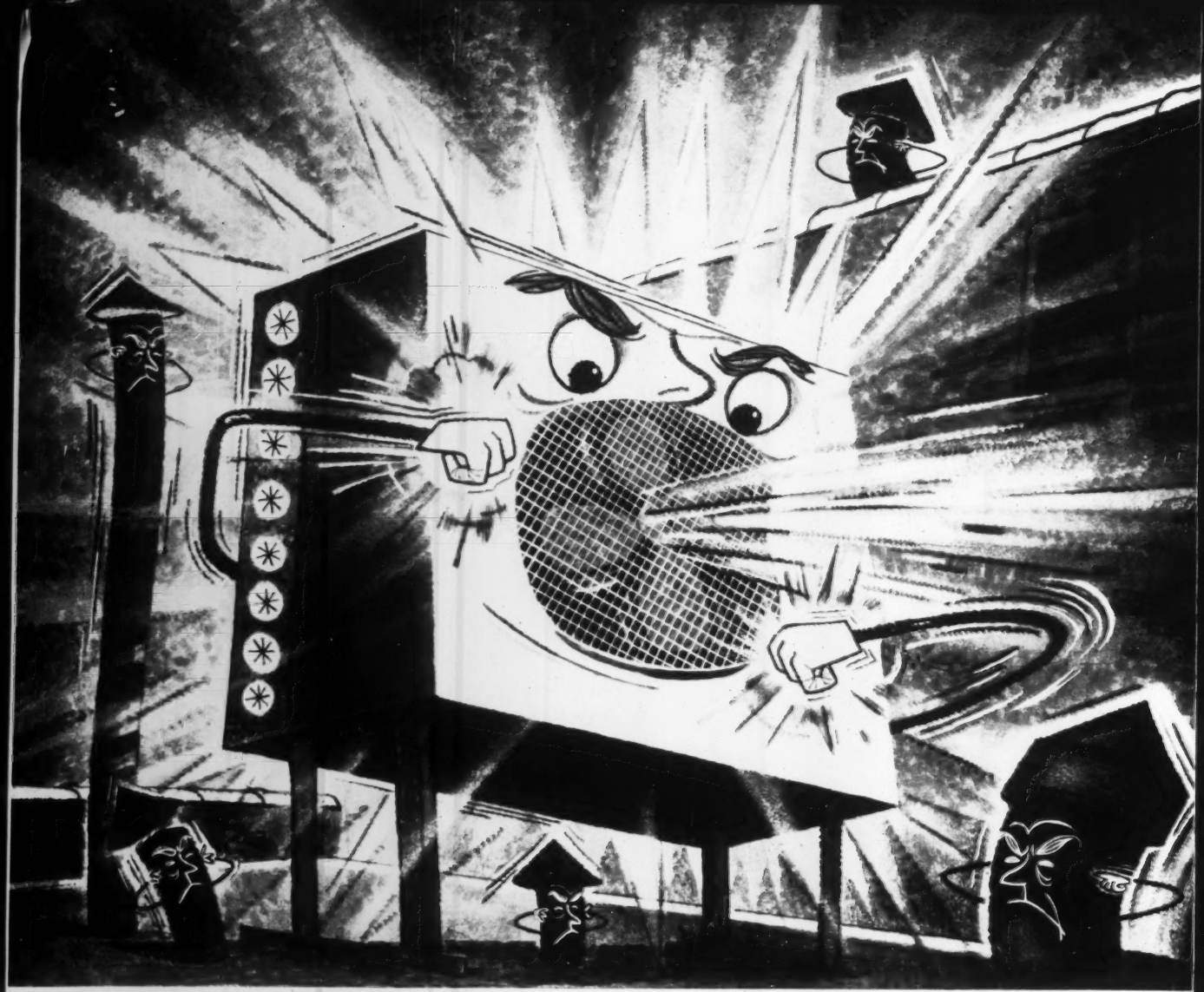

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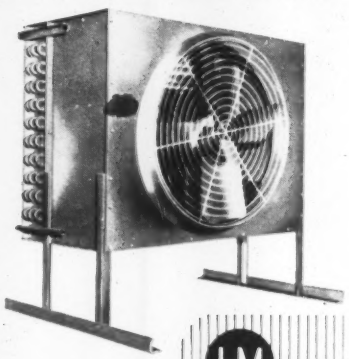
Not even from close up if they're by Halstead & Mitchell

Fan noise, vibration and rattling have been engineered out of H&M air-cooled condensers. Deep pitch fans are run at slow speeds. Casings are rugged; won't loosen with use.

H&M condensers are completely dependable. The large coil and exclusive Turbu-Flo fins improve heat transfer by up to 15%. Fins are spaced widely to avoid clogging by dirt and other air-borne particles.

Winter operation is easy, too, with H&M's special modulating valve. Halstead & Mitchell air-cooled condensers are available in propeller fan or blower models. Multiple circuiting at no extra cost. Ask your local distributor for complete information, or write to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.



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RAPID RESPONSE REMOTE BULB AND WELL
- Reduces danger of floodback
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Alco Designed...
for easy capacity changes or cleaning without breaking connections or removing valve from line.
Simply ... loosen 2 bolts ... lift out cage ... clean and replace.

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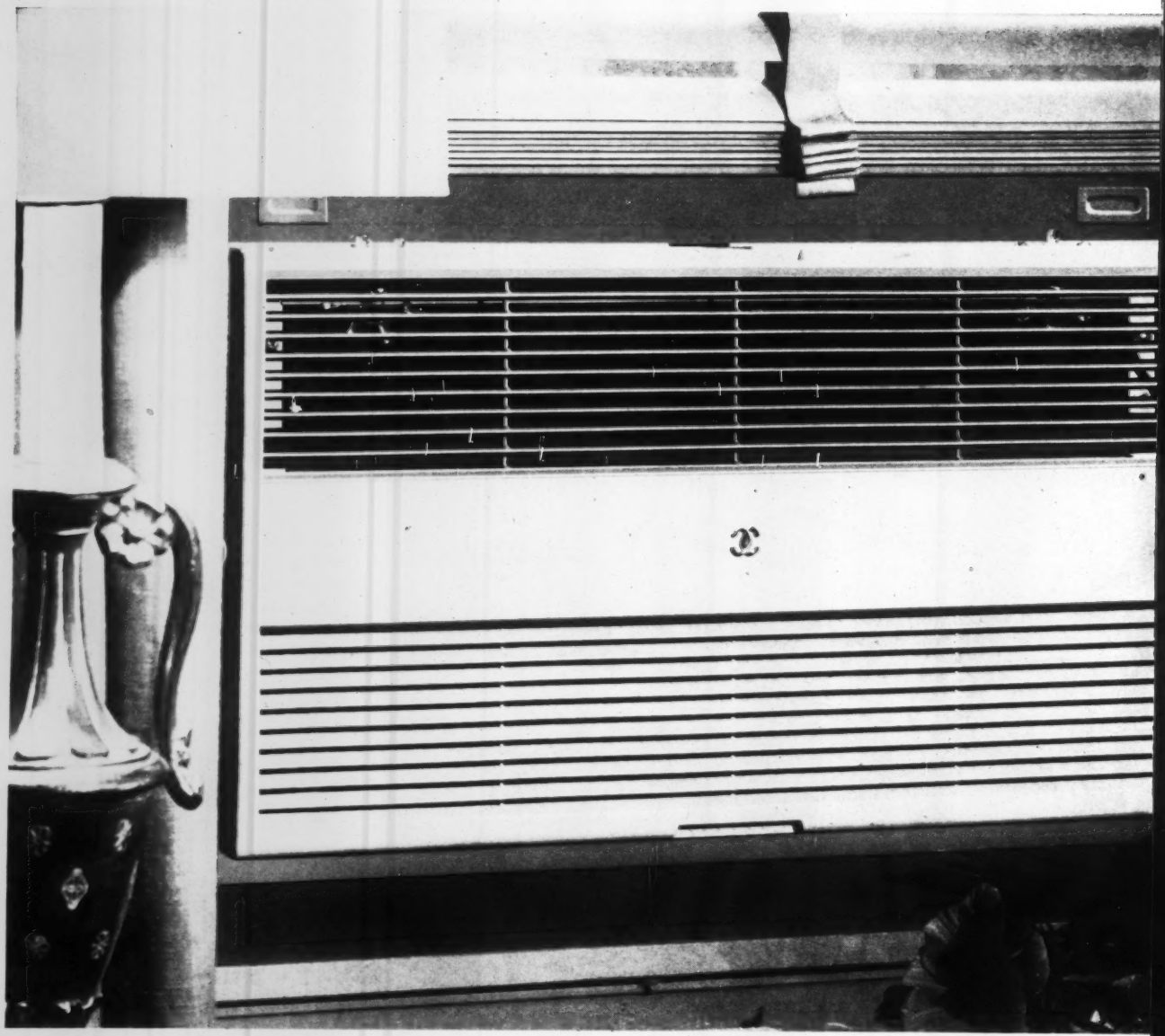
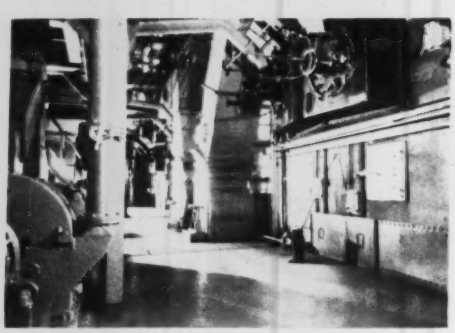
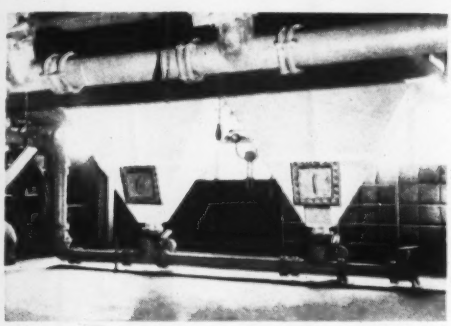
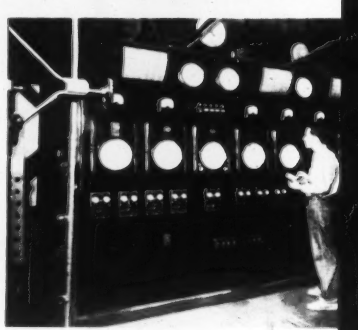




General view of Carrier power plant. Boilers on right are bent tube, two-drum types, by Riley Stoker Corp. burning pulverized coal. Coal moves from bunkers to Riley Pulverizers (at left in photo) and then into furnace.



Mechanical dust collectors by Prat-Daniel Corp. help assure cleanliness of operation. These collectors tie in with United Conveyor ash handling system for movement to ash silo and final disposal.



Pneumatic automatic control panel by Bailey Meter Co. regulates combustion operation of all boilers and auxiliary equipment, maintains continuing steam generation efficiency!

Carrier puts the chill on fuel costs...with coal

Air conditioner manufacturer uses coal for low-cost steam

An unusual team—the heating ability of coal and the cooling facility of air conditioning equipment! Yet Carrier Corporation, Syracuse, N.Y., found this combination profitable when expansion plans required additional capacity in its steam plant. After engineering surveys, Carrier decided to continue burning coal for economy of operation. Today modern power equipment supplies steam *economically* for heating, air conditioning and processing. Original fuel costs plus automatic operation within the power plant hold overall steam costs to a minimum.

Coal is lowest cost fuel

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% *more* steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

To help you with fuel problems, the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to address below or send coupon. Ask also for our case history booklet, complete with data sheets. You'll find them informative.

Consult an engineering firm

If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you with the efficiency and economy of coal.

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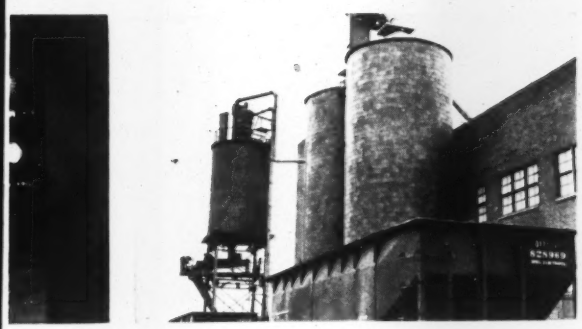

Coal is loaded into silos before it moves to bunkers. At left is the ash silo which utilizes rotary dustless unloader in loading trucks for disposal. Silos and conveyors are by Fairfield Engineering Co.

SEND COUPON FOR NEW BCI PUBLICATIONS. Guide Specifications, with complete equipment criteria and boiler room plans:

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(If you haven't already got yours, get it now!)

Offer good through August with purchase of 22 lbs. or more of

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It's a Cylinder Carrier!
Grab it anywhere! Carry ring is 22 inches around.
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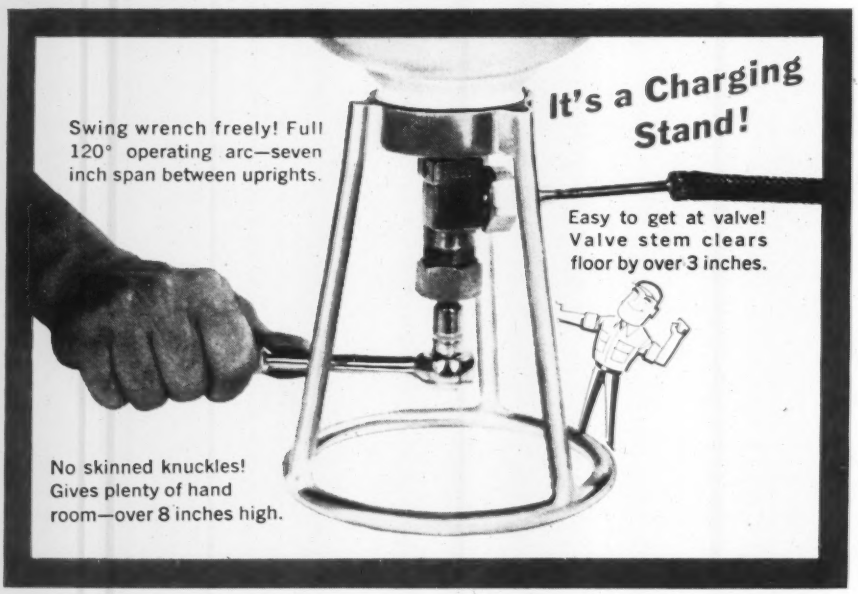
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No skinned knuckles! Gives plenty of hand room—over 8 inches high.

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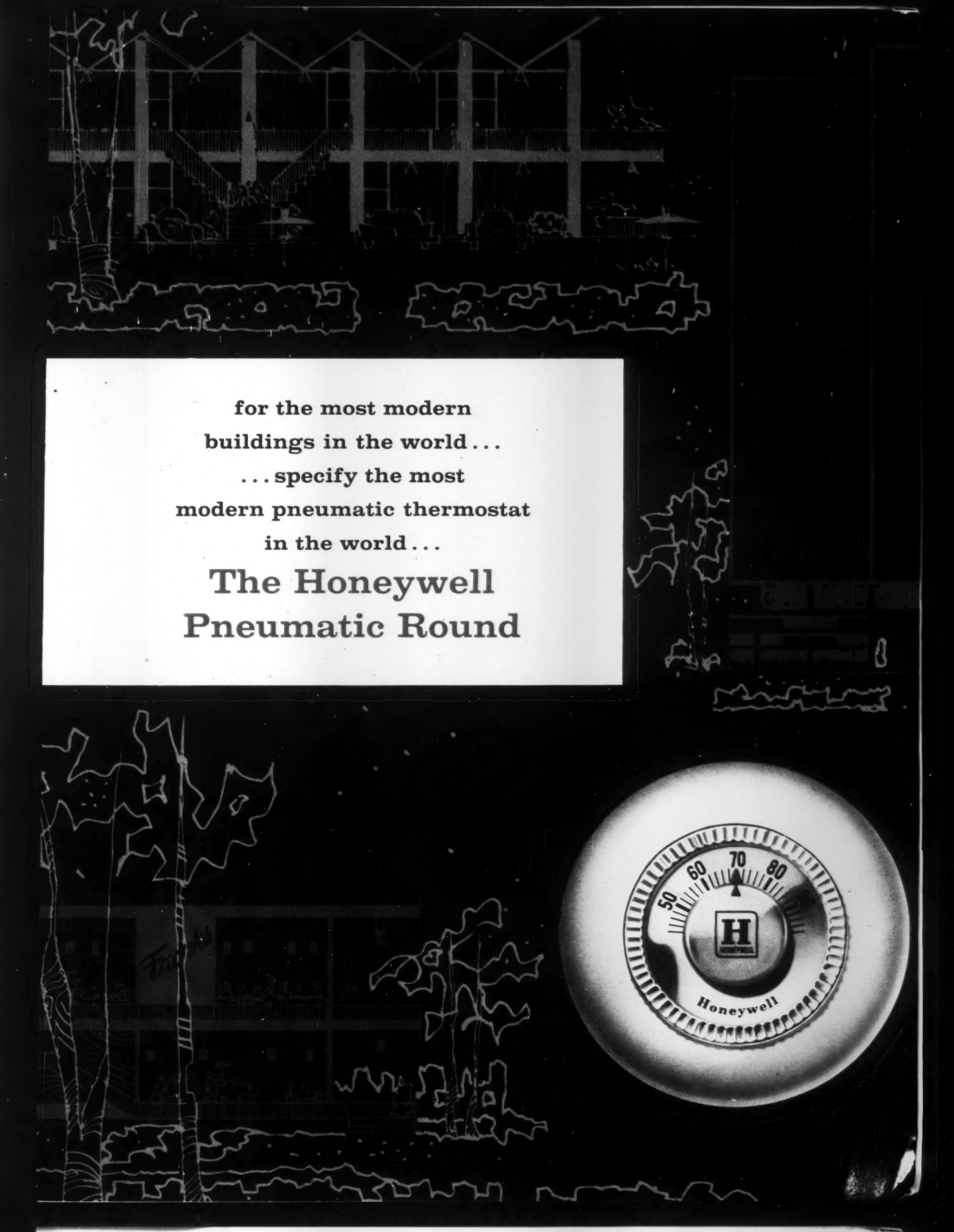
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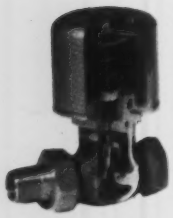
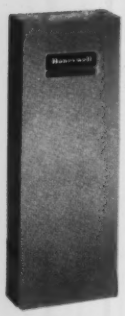
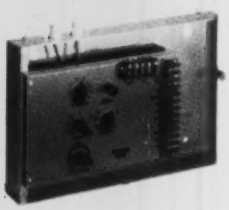
New examples of Honeywell's leadership in pneumatic controls—all perfectly matched for top performance



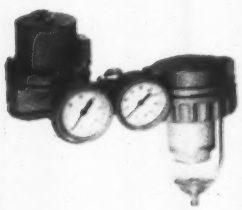
New Small Valves (V0520A and C; V0521A) For individual room temperature control. Newly designed, both valves incorporate a new rolling-type diaphragm actuator which greatly increases capacity and close-off ratings, in a compact size. V0521A (illustrated) is available in normally open, straight-through or angle patterns. For both steam and hot water applications.



New Automatic Air Dryer (W025A2) For an improved primary source of dry control air. Only Honeywell offers a twin-bed dryer with automatic time programming for regeneration of the beds. Provides a reliable source of dry air, yet requires very little maintenance—an ideal solution to the problem of extracting moisture from compressed air supplied to the control system.



New Electronic-Pneumatic Relay (R07903 A and B) For precise control of conditioned air or water sources. Fully transistorized, the R07903 employs electronic sensing, pneumatic positioning—combines the sensitivity of electronic thermostats with pneumatic operators. Designed for summer or winter applications, with provision for both discharge and outdoor compensation.



New Pressure Reducing Valves and Filter Station (P0902 A and B) For better primary source of clean control air at the proper pressure. Advanced engineering and new design result in a fully integrated two-unit system—filter with transparent housing and replaceable filter element, and pressure reducing valve with built-in safety pressure relief valve. Plastic housing signals need for filter change by coloring when dirty.

New Piston Motors (M0903 A and B; M0904 A and B) For exact damper positioning. Brand-new pneumatic power unit for positioning dampers. Has rolling-diaphragm operation for high force output, long life. Universal mounting bracket permits external or internal installation on all makes of dampers.

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1 Introduction of a material such as expanded perlite into a granulated hard asphalt improves the insulating value of the blend.

2 Proper selection of asphalts by softening point to make up asphalt-perlite blends improves the insulating properties of the blend.

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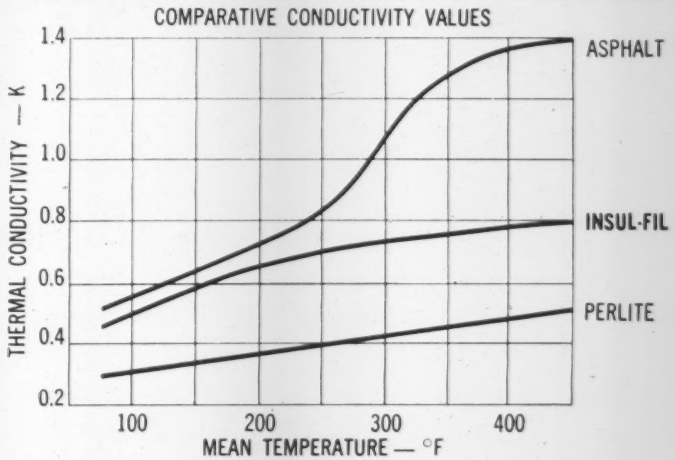


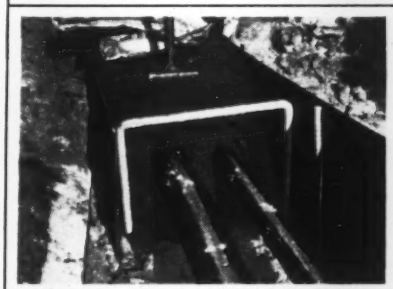
After years of extensive testing conducted at the Research and Development Department of The Atlantic Refining Company, these conclusions were presented in a Paper given before the American Chemical Society in Dallas, Texas, April, 1956. Since that time, hundreds of Insul-fil field installations have confirmed these conclusions.*

It is a well-known fact that the use of asphalt in construction created the necessity for the introduction of fillers (usually inorganic) of various types for the purpose of arresting the flow characteristics and improving the insulation value of the asphalts themselves.

The blend of hard granular asphalt and asphalt coated perlite gives Insul-fil its excellent insulating properties, water resistance and sufficient structural strength to the insulating body to resist normal soil stresses with the steam on or off.

An important Insul-fil development is the priming of the pipe with Accelerator #7591. The use of accelerator provides continuous adhesion of Insul-fil to the pipe, hastens consolidation, and gives additional protection against corrosion by galvanic action.

**Paper available on request.*



Insul-fil Is Simple To Install

Just pour it around the pipe to be insulated. Prod and tamp it in place and backfill. Heat introduced into the pipe forms the conduit.

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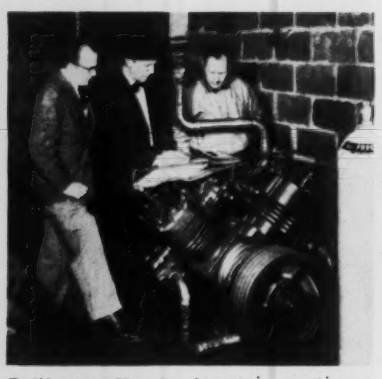
Insul-Fil Company Inc. DIVISION OF: MIRACLE ADHESIVES CORPORATION, 250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N. Y.

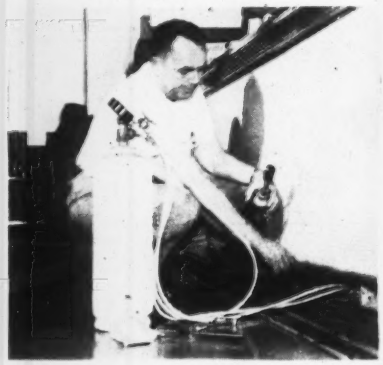


Baltimore, Maryland, service engineer reports: "'Freon' refrigerants help us do a better servicing job. It's dry and safe—the most dependable refrigerant on the market today."

East Rockaway, New York, contractor reports: "Nothing works like 'Freon'. I'm convinced it's the best refrigerant on the market—safe and dependable for any job."

Louisville, Kentucky, service man reports: "'Freon' is the world's best refrigerant for our money. It's pure, dry and safe—never causes one bit of worry or trouble."

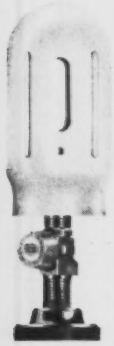
Atlanta, Georgia, contractor reports: "We've never had a bad batch of 'Freon' in the 25 years we've used it. It's never caused us trouble on the job or—after years of service—in a system."



Tucson, Arizona, service man reports: "'Freon' refrigerants help us do the best job possible. They're reliable and safe. Since 'Freon' came out, we've never used anything else."

St. Louis, Missouri, service man reports: "We've never had a moisture or corrosion problem in equipment charged with 'Freon.' It's absolutely dependable—always pure and dry."

All over the country, users are talking about the advantages of Freon* refrigerants



East, west, north or south—contractors and service men appreciate the extra quality of "Freon" refrigerants that costs them nothing extra.

"Freon" is today's premium-quality refrigerant . . . stable, pure, dry—nonflammable, nonexplosive, nontoxic. It's time-tested—in use over 27 years and made only by Du Pont—backed by years of technical and manufacturing leadership.

Specify "Freon" refrigerants for every refrigerant need. Your Du Pont wholesaler has it—now capped in gold and factory-sealed to guard its purity till you're ready to use it.

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BETTER THINGS FOR BETTER LIVING ... THROUGH CHEMISTRY

FREON® *premium quality* **REFRIGERANTS**

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Heating Piping & Air Conditioning

August 1959

You'll Want To Know...

Air Conditioning Conference Stresses Proper Maintenance

"AIR CONDITIONING is a way of life and important in every phase of Air Force operation," stated Lt. Gen. W. F. McKee, vice commander, Wright-Patterson Air Force Base, as he opened the Air Force air conditioning conference at this installation last month.

Major General A. M. Minton, of the Air Force headquarters, noted that much of the electronic equipment necessary in weapons systems would be useless without environmental control because of the high rates of heat generation. Air conditioning is easily justified, as evidenced by the example he cited where $50,000 worth of air conditioning may protect $30 to $50 million worth of electronic equipment.

One of the several areas of particular importance to the Air Force is the proper maintenance of air conditioning equipment, General Minton said. This will become greater in importance as the total quantity of air conditioning in service becomes increasingly larger and the equipment becomes progressively older.

General Minton stated that the Air Force will require certification of all air conditioning equipment under the program conducted by the Air-Conditioning & Refrigeration Institute at some future date. He also mentioned that the Air Force would like to see reliability and service life included in this certification program.

The extent of air conditioning applications and their growth were outlined by William T. Smith, chief of the Refrigeration & Air Conditioning Section, Hq., U.S. Air Force. From an investment of $40 million in 1948, the Air Force's investment in air conditioning grew in 10 years to $400 million, and he predicted that by 1960 it will be $500 million. At the present time, approximately 90 percent of the investment is for protection of equipment, 2 percent for living quarters, and 8 percent for other personnel applications. The maintenance costs have risen from $3 million in 1950, and it is estimated they will exceed $10 million in 1960.

Over 300 attended the conference, one half of whom represented Air Force Commands and major installations throughout the world.

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

Study Air Cooled Condenser Maintenance Problems

A PROGRESS REPORT on air cooled condensers was presented at the recent Air Force air conditioning conference last month by Warren Viessman, mechanical engineering consultant for installations, Hq. Air Research and Development Command. Mr. Viessman stated that air cooled condensers are making air conditioning possible in many areas where water is not available and where water is of poor quality.

A total air cooled condenser capacity of 170 tons was installed a few years ago at Patrick Air Force Base in sizes of about 40 tons each. Mr. Viessman referred to this as one of the pioneer installations. Today there is a total of 970 tons of air cooled condenser capacity at this base plus a considerable tonnage at Cape Canaveral and on the down range islands. He pointed out that it would be extremely difficult to operate without these units.

However, air cooled condensers are not without their problems in coastal areas where they are subjected to salt sea spray, he continued. The effect of this corrosive spray on condensers of standard construction having aluminum fins on copper tubes has been studied in a number of installations that have been in service. In one such case, 1800 ft from the sea, where large coils have been in service for six years, some corrosion has been noted, although the performance has been satisfactory. Inspection revealed that about four more years of life could be expected, making a total expected life of 10 years, he said.

Aluminum fins on another installation, 8 ft above the ground and 200 ft from the sea, which has been in operation for two years, were recently found to be completely corroded and required replacement. It appears from a study of many units that aluminum fins are satisfactory when mounted on roofs or in elevated positions and at a distance from the sea of at least half a mile. These coils should be wholly or partially protected from spray when they are operated continuously, he said.

Copper fins have been provided on some recent installations at an increased cost of about 15 percent, and a number of these units have been inspected. It was found that they were not noticeably affected whether installed near the ground, or at higher elevations, or close to the sea.

He said the additional cost of the copper fins is justified for locations close to the sea and where operation is intermittent.

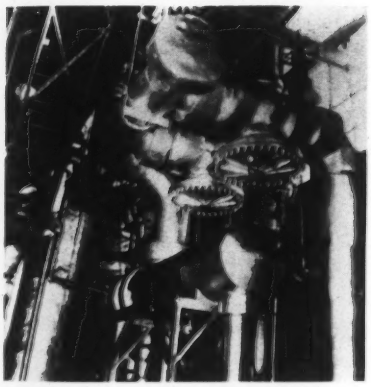
You'll Want To Know

Air Conditioning Aboard Ship Reduces Seasickness

COMPLETE air conditioning for passengers, crew, cargo, and ship's stores will be features of four new American Export Lines vessels, according to Carrier Corp.

"Cargo air conditioning is essential to keep product aromas from mingling and to avoid spoilage," Frazier A. Bailey, managing director of the American Export Lines said. He also pointed out that the removal of engine room and galley odors which may cause sea sickness is aided by air conditioning.

Five reciprocating refrigeration compressors will provide the 100 tons of cooling capacity in each ship.



Hospital Steam Needs Controlled Over Wide Range of Pressures

SEVERAL ingenious control and piping systems at the Pilgrim State Hospital, West Brentwood, Long Island, N. Y. provide its steam service with maximum dependability and flexibility, according to Spence Engineering Co., Inc.

For example, to control heat and auxiliary steam for more than 100 buildings and a greenhouse during winter months, a novel arrangement of seven 8 in. regulating valves reduces boiler steam from 155 psi to 55 psi or 3½ psi. When pressure in the heating main drops below 3½ psi, two regulators open automatically.

Two more 8 in. valves in parallel reduce boiler steam to 108 psi for laundry service. Another reduces pressure to 55 psi for cooking and kitchen steam tables. This system is valved and connected so that a number of combinations of pressure reduction and steam flow are possible.

Pilgrim State's main steam plant has six boilers which produce 4,800,000 lbs of steam per day at 155 psi during the winter.

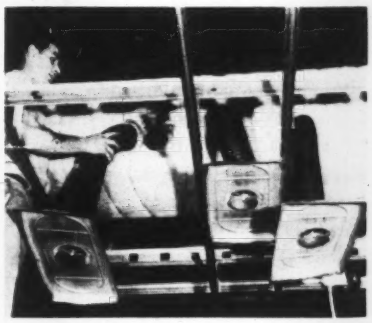
Weather Data for Humidity Control

THE Electric Space Heating and Air Conditioning Committee of Edison Electric Institute has issued a 32 page report entitled "Weather Data For Humidity Control Air Conditioning." This new publication is a compilation of weather data for various areas of the nation served by some 20 investor-

owned electric light and power companies. Information included is for both heating and cooling seasons, showing average mean temperatures, dewpoint, humidity, etc.

A summary included in the report points out that there is a potential market for air conditioning equipment in less humid areas, in the higher altitudes and in the normally cooler northern sections of the country, if cleanliness as well as temperature and humidity control aspects are stressed.

Copies of the report are available from Edison Electric Institute, 750 3rd Ave., New York 17, at $1.50.



Air Distribution System Permits Office Flexibility

UNCLUTTERED ceilings and freedom of partition movement have been achieved through use of low velocity air diffusion in a new modular-designed industrial project at Sikorsky Aircraft, Stratford, Conn.

For the company's new quarters, 5100 air diffusers have been installed in the acoustical pan of the office, general and engineering space, according to the Pyle-National Co. The fixtures consist of flush-fitting, modular diffusion panels connected by flexible tubing to the duct system. By means of a valve arrangement within the panel, the air velocity is reduced to 30 fpm and then introduced into the room.

The system was designed by Albert Kahn Associated Architects and Engineers, Inc. and was chosen because it suited the needs of the modular design of the building. Each module is self sufficient as far as heating, air conditioning, and ventilation.

Elect New ASHRAE Officers At First Annual Meeting

R. C. Cross Replaces A. V. Hutchinson As Executive Secretary

THE FIRST ANNUAL meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers was held recently at Lake Placid, N. Y., with some 700 members, guests, ladies, and children present. Arthur J. Hess accepted the presidency for the next six months from retiring president Cecil Boling, and will serve for that period under the terms of the merger agreement. He is the first president of the ASHRAE to have also served as president of the American Society of Heating and Air-Conditioning Engineers and the American Society of Refrigerating Engineers. Other new officers are D. D. Wile, first vice president; W. A. Grant, second vice president; R. H. Tull, third vice president; John Everetts, Jr., fourth vice president; F. Y. Carter, first treasurer; and J. H. Fox, second treasurer.

The papers presented at the three-day meeting covered a wide variety of subjects. Most of them were on refrigeration and cooling, but conference sessions were also held on industrial ventilation (reported in this issue on pages 102 to 104) and on piping materials for cryogenics (reported in this issue on pages 94 and 95).

A significant change announced shortly after the meeting was the appointment of Robert C. Cross as executive secretary to succeed A. V. Hutchinson, who became "executive secretary emeritus" on July 1. Mr. Cross, formerly executive secretary of the ASRE, was appointed to that post in December 1954. Mr. Hutchinson had served the ASHAE as executive secretary and manager of publications over a period of more than 37 years, and had been executive secretary of the new society since the merger early this year.

Another staff change was also announced a few days later. W. M. Vidulich, who had headed public relations for the ASHAE prior to the merger, and advertising sales for the ASHRAE since the merger, has left the society's headquarters staff.

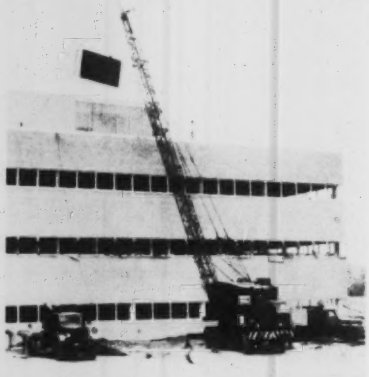
Contractor Stresses Overhead's Importance

THE IMPORTANCE of a mechanical (heating, piping, and air conditioning) contractor's overhead costs—and the importance of a contractor knowing what his own overhead is—were stressed recently by William P. Scott, Jr. As president of the Mechanical Contractors Association of America, he was a special guest at the annual dinner of the Mechanical Contractors Chicago Association, held at the Drake Hotel.

Paul H. Kroeschell (Kroeschell Engineering Co.) was re-elected president of the Chicago association at the annual meeting preceding the dinner. James H. McCauley, Jr. (James J. McCauley & Sons, Inc.) was re-elected vice president, Charles E. Crone (Charles E. Crone Co.) was re-elected treasurer, and S. L. Haas (Advance Heating & Air Conditioning Corp.) was re-appointed secretary; Edward R. Teske is the executive secretary of the Chicago group.

You'll Want To Know

Guests of the association at the dinner included a number of Chicago consulting engineers; architects; representatives of the Ventilating Contractors Association; the United Association; the electrical contractors; and the city and county's public works and building department officials.



Two Stage Heat Pump Serves New Office Building

THE FIRST two stage air-to-water heat pump in New England is being installed in the new Western Massachusetts Electric Co. office building in West Springfield, Mass., according to Worthington Corp.

Heated all electrically by a combination of heat pumps sized for the cooling load, supplemented by stored hot water, heated electrically at night, it is expected that this installation will provide extremely economical heating for these new offices.

Year-round air conditioning is provided by a combination of direct radiation and dual duct air distribution, with the hot (105 F) or cold (45 F) water furnished by a two stage air-to-water heat pump system. Two compressors (30 hp and 100 hp) and a 20 in. × 12 ft chiller-heater are located in the basement, together with the hot water and chilled water pumps, the hot-water storage tank and supplementary heaters, and control panels. On the roof are the two outside air coils, each 100 sq ft and each circulating 52,000 cfm, which operate as air cooled condensers in the summer and a heat source in the winter.

Although seasonal change-over is manual, the control system provides for automatic two staging of the compressors when outside temperature is below 25 F. This allows operation at a much better performance factor, as high as 3, even at low outdoor air temperatures.

You'll Want To Know

L.A. Industry Spends $70 Million for Smog Control Equipment

UNUSUAL air pollution controls being used in the Los Angeles battle against smog were scrutinized by more than 1000 specialists during the recent conference of the Air Pollution Association, according to Smith Griswold, Los Angeles County Air Control Pollution Control Officer, and chairman of the meeting.

Los Angeles was chosen as the site for the 52nd annual convention, because of the extent of the air pollution control effort there. Industry in Los Angeles County has spent more than $70 million on control equipment including evaporation controls on refinery storage tanks and loading racks, sulphur recovery plants, and electrical precipitators for steel plants.

Speaking at the convention, Harry M. Pier, executive secretary of APCA, said more than $250 million a year is spent by industry for the construction and operation of air pollution control equipment in the U. S. Some manner of air pollution control regulations have been adopted by over 2000 communities and over 20 states, while legislation in many other areas is being considered, he pointed out.

Construction Contracts Continue to Grow

CONTINUED gains in housing, manufacturing buildings, and commercial buildings boosted construction contracts in May in the U. S. to $3,541,858,000 — an increase of 4 percent over the same month last year.

The seasonally adjusted figures, released by the Dodge Index of Construction Contracts, were reported somewhat down from the all-time peak reached in April of this year. Nevertheless, the index in May continued at a level above last year's average.

Contracts for non-residential buildings in May were valued at $1,071,520,000, down 5 percent from a year ago. Sharp gains in contracts for commercial, manufacturing, and religious buildings were more than offset by declines in the other nonresidential building types.

Cumulative totals of contracts for the first five months of 1959, with percentage changes from the comparable 1958 period were as follows: non-residential building at $4,669,710,000 — up 3 percent; residential building at $7,126,054,000 — up 39 percent; heavy engineering at $3,434,570,000 — up 4 percent; and total construction at $15,230,334,000 — up 17 percent.

Store Continues Business 'As Usual' During Air Conditioning Installation

AS A RESULT of careful planning, New York City's Stern Bros. department store has been able to carry on "business as usual" during installation of a 1300 ton capacity air conditioning system, according to Spence Air Conditioning Co.

The present work includes installation of two steam operated 650 ton refrigeration units in an unused sub-basement boiler room, four air handling units on five sales floors, and 5000 lineal ft of duct, mostly in sales areas.

The two refrigeration units were lowered to the sub-basement through

a freight elevator shaft, bypassing sales areas. Parts for the water cooling tower were hoisted directly to the roof from the street level, while chilled water and condenser water piping has been located in storerooms and stairwells.

All this was accomplished without disrupting sales activities or interfering with customers by erecting temporary dust-tight walls around construction areas.

Radioisotope Conference Set for August 20-21

A TWO DAY SYMPOSIUM on the subject of industrial uses of radioisotopes will be held on August 20-21 in Buffalo, N. Y., according to the U. S. Atomic Energy Commission. The meeting is being planned in cooperation with the University of Buffalo, Canisius College, and the Buffalo Chamber of Commerce.

Additional information regarding the symposium may be obtained from Charles F. Light, General Manager, Buffalo Chamber of Commerce, 238 Main St., Buffalo 2.

To Promote 'Hydronics' for Large Buildings

FORMATION of a commercial-industrial "task force" or "study group" by the national Better Heating-Cooling Council was announced by Henry M. Gibb at the first annual meeting of the Chicago Better Heating-Cooling Council. Mr. Gibb — sales manager of the Pacific Steel Boiler Div., National-U. S. Radiator Corp., Johnstown, Pa., — said its purpose would be "to direct the proper activities toward encouraging the continued use of hydronics in larger types of construction" and to "combat growth" of other methods of heating and cooling such structures.

He listed five categories of structures in the order "of the competitive threat to them and to establish priorities of attack" as follows:

Schools and churches.

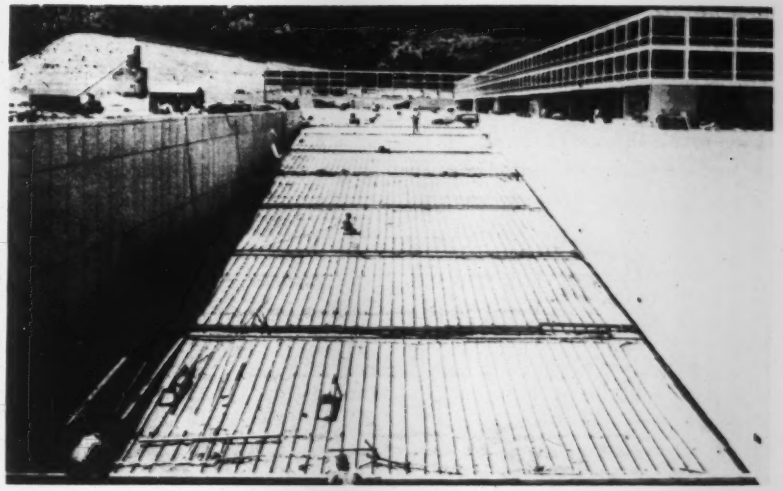
Small apartment buildings, motels, small hotels, and public housing.

Shopping centers, small stores and shops, chain stores, office buildings.

Federal, state and local government buildings — including military.

Large hotels, office buildings, hospitals, and apartments.

George W. Bornquist of Bornquist, Inc., was elected president of the Chicago council, succeeding J. P. Baldwin (of J. P. Baldwin Co.) who served as the first president of the group.



Install Ramp Snow Melting System at New Air Force Academy in Colorado Springs

A NEW SNOW MELTING system in a 5000 sq ft sloping ramp at the Air Force Academy has been recently installed, according to A. M. Byers Co. The system includes a network of wrought iron pipe grids embedded in the concrete ramp on 14 in. centers. The pipe was positioned 1½ in. below the surface of the 7 in. thick concrete slab. Before the concrete was poured, the piping system was hydrostatically tested at 200 psi for 24 hours.

A mixture of 44 percent ethylene glycol and hot water at 135 F is circulated through the system by a vertical split case pump at the rate of 1400 gpm.

AGA Reports Gas Sales Rise

INCREASED GAS USE by industrial customers helped boost April sales of the gas utility and pipeline industry to 7737 million therms, according to the American Gas Association. In addition, AGA reported that total gas sales for the year ending April 30 amounted to 82,535 million therms. This represents a 4.5 percent increase over the 78,975 million therms sold during the previous 12 month period.

Fenner and Proffitt Form New Engineering Firm

William E. Fenner and Charles Y. Proffitt have announced the formation of the new consulting engineering firm bearing their names in Wilson, N. C. Mr. Fenner has been in private practice in Raleigh, N. C. and both Mr. Proffitt and Mr. Fenner were with L. E. Wooten & Co., consulting engineers, previously.

You'll Want To Know

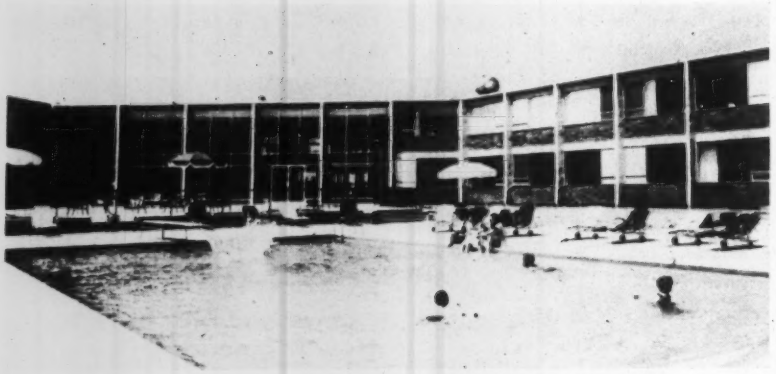
Central System Air Conditioning Is Trend In New Manhattan Apartment Construction

AIR CONDITIONING of new apartment houses in Manhattan, a rarity only five years ago, is now included in new buildings almost without exception.

This is the conclusion of a survey made by Frank Hudik, president of Hudik-Ross, Inc., mechanical (heating, piping, and air conditioning) contractor in New York City. The study, which included both rental and cooperative apartments, revealed that, of 58 structures completed this year or now under way, 96 percent have air conditioning.

As recently as 1955, only three of 13 buildings completed that year had air conditioning equipment. It was a year later that the influence of air conditioning first made itself felt. In 1956, of 37 buildings surveyed, 20 had the built-in individual units, with the remainder containing special air conditioning outlets.

A definite trend exists today toward central systems, according to Mr. Hudik. Whereas only six buildings erected in the 1947-58 period were centrally cooled, five buildings completed this year or now under construction have central air conditioning systems.



Low Noise Level Designed Into Airport Hotel System

LOW NOISE LEVELS was a primary factor in designing the air conditioning system for the new Hopkins Airport Hotel at Cleveland's air terminal, according to Carrier Corp. Soundproofing of the building and a carefully designed chilled water system to supply fan-coil units in each room are the principal reasons the 145 guests will not be disturbed by noise from the nearby airfield.

Each guest room is along the outside wall and has individual controls for both heating and cooling. Hot water is supplied to the fan-coil units during the winter in accordance with outdoor conditions. However, while on the cooling cycle, constant temperature chilled water is circulated through the system.

Units serving the lobby, coffee shop, and conference rooms are in a service area and deliver the conditioned air through ducts and diffusers. Air is supplied continuously and the temperature of the air is controlled.

You'll Want To Know

New Bulletin Tells How to Apply Piping Identification Symbols

A NEW BULLETIN — "Recommended Practice for Permanently Affixing Identification Symbols to Fabricated Piping" — has recently been made available according to the Pipe Fabrication Institute.

The bulletin informs users of fabricated piping of the identification methods which have proved most satisfactory — economically and metallurgically.

Copies may be obtained without charge by writing the institute at One Gateway Center, Pittsburgh 22.

Bidding and Insurance Booklets Available from AGC

THREE new publications of value to architects, engineers, contractors, and construction contract awarding authorities are now available, according to the Associated General Contractors of America. They include:

"A Recommended Guide to Bidding Procedure on Engineering Construction" — an up-to-date reference and procedural document for use in competitive bidding on engineering and construction projects.

"A Suggested Guide to Bidding Procedure on Building Construction" — establishes recommended practices for use in lump sum bidding for private work — applicable on public work where requirements permit.

"Insurance and Bond Check List" — includes type of insurance and bonds commonly used by general contractors.

Individual copies of these documents may be secured without charge from the Associated General Contractors of America, 20th and E Sts., N. W., Washington 6, D. C.

Cooling Tower Standard Available: NFPA

A NEW STANDARD on water-cooling towers has been released by the Na-

tional Fire Protection Association, according to Robert S. Moulton, technical secretary of the association.

Development of the standard has been occasioned by a series of major fires in cooling towers, some of which represented values of as much as $1.25 million. While the fire hazard is greater when towers are out of service, many fires have also occurred when towers were in use.

The standard is expected to be used widely as a guide since heretofore there has been no nationally accepted guide to follow.

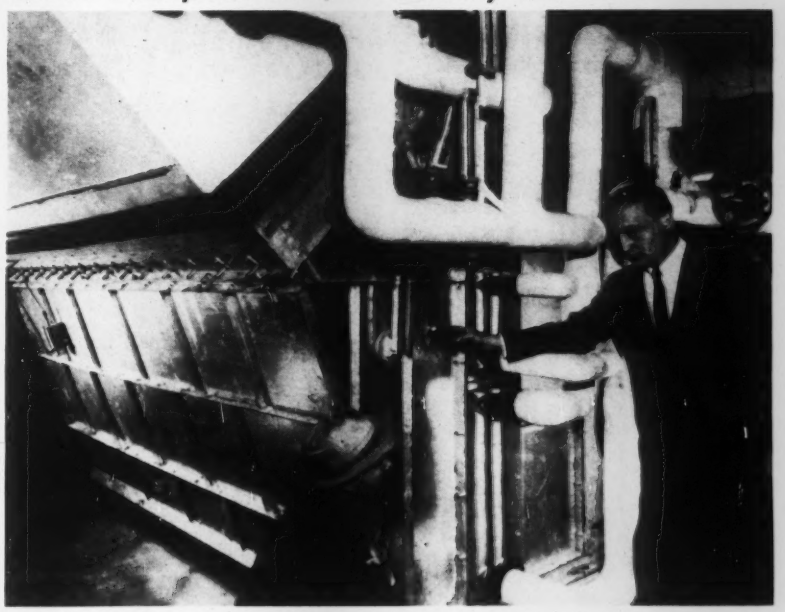
Copies are available (NFPA No. 214, 16 pages, 40 cents) from the National Fire Protection Association, 60 Batterymarch St., Boston 10.

Engineering Societies Directory Now Available; Lists Staff Personnel

THE Engineering Societies Directory, 1959 edition is now available from Engineers Joint Council. It is the only comprehensive U. S. listing of engineering and scientific societies, their functional staff personnel and publications, all state registration board for professional licensing, and a complete listing of Canadian engineering organizations.

Copies of the directory may be obtained from Engineers Joint Council, 29 W. 39th St., New York 18, at $3.50 per copy.

New Lab, IBM Room Demand Close Temperature, Humidity Control



FOUR air distributing units have been installed with two air conditioners to maintain strict temperature and humidity control in a spectograph lab and IBM room of the new Mallory-Sharon Titanium Corp. office and lab building in Niles, Ohio, according to Westinghouse Electric Corp.

The four units deliver a total of 76,000 cfm of cooled and filtered air to maintain a dry bulb temperature of 80 F at 50 percent relative humidity.

To keep the air in the spectograph lab (with its cooling requirement of 97,000 Btu removed per hr) at a very constant temperature and moisture content of 72 F and 50 percent relative humidity, the contractor installed an air conditioning unit with electric reheat coils and hot water humidifiers.

The unit with electric reheat coils and hot water humidifiers installed in the IBM room keeps its strict air requirement at 73 F and 45 percent relative humidity and the cooling load there is 200,000 Btu per hr.

ASTM Water Treatment Award to L. D. Betz For Committee Service

L. DREW BETZ, president and director of Betz Laboratories, was presented with the sixth Max Hecht Award June 25 at the 62nd annual meeting of the American Society for Testing Materials at Chalfonte-Haddon Hall, Atlantic City, N. J. The award, established in 1954 by ASTM Committee D-19 on Industrial Water in honor of its first chairman, is given in recognition of outstanding service to the committee in the advancement of its objective—the study of water as an engineering material.

Fluid Controls Institute Elects New Officers, Sets Next Meeting

THE SPRING meeting of the Fluid Controls Institute was held recently and the following officers were elected:

President: James R. Lawler, Jr., Lawler Automatic Controls, Inc.

First Vice President: Fred Weldon, General Controls Co.

Second Vice President: Robert McCormick, Automatic Switch Co.

Treasurer: Paul Rogers, Skinner Chuck Co.

Corporate Secretary: E. A. Bianchi, Mason-Neilan, Div. of Worthington Corp.

Executive Secretary: E. R. Rath.

The fall meeting of the Institute will be held in the Drake Hotel, Chicago, November 23-25, 1959.

You'll Want To Know

Rockefeller Center Air Conditioning Capacity to Be Increased

THE world's largest integrated air conditioning system — at Rockefeller Center in New York — will be expanded with the addition of a 1500 ton capacity centrifugal refrigeration machine, according to Carrier Corp. The new unit will increase the Center's system capacity to 16,677 tons, and it will be installed adjacent to two other such units in the sub-basement.

A total of 27 refrigeration machines have been installed at Rockefeller Center since 1932. The Center became the world's air conditioning leader in September, 1957 when it surpassed the 14,300 ton system in Washington's Pentagon Building.

ARI Rating Data Directory Available

THE July edition of the "Directory of Certified Unitary Air-Conditioners", listing ARI rating data on 1611 models, is now available from the Air-Conditioning and Refrigeration Institute.

Copies of the new directory may be obtained from ARI, 1346 Connecticut Ave., N. W., Washington 6, D. C.

Two Separate Systems Serve New Music Library

Two separate air conditioning systems are being planned for the new Gaylord Music Library at Washington University in St. Louis, Mo. One system will serve the entire library, stacks, and offices on the second floor. This will be an all-air system, which will allow for variable temperature control for the different zones on the floor.

The second system will serve the music rooms on the ground floor. This will also be an all-air system with individual room temperature controls.

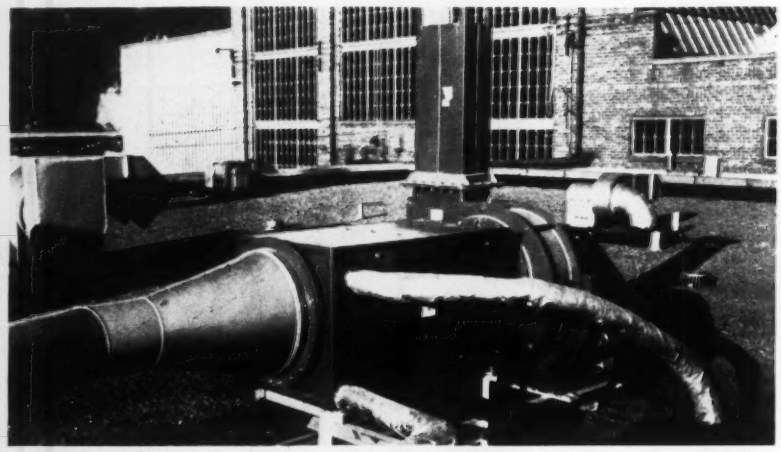
During mild weather the system will circulate 100 percent outdoor air for ventilation.

Since noise control is a very important consideration in this new building, sound absorption devices will be incorporated to reduce and control the transmission of sounds through ducts between rooms.

As another insurance against sound transmission, all listening rooms are isolated with an air space. An air space will also be left between the ceiling of the first level and the floor of the second level.

The air conditioning systems are being designed by the Albert Rich Co., consulting engineers.

You'll Want To Know



PVC Exhaust System Resists Corrosion of Acid Fumes

AN UNPLASTICIZED rigid PVC exhaust system has been installed at Gardner-Denver's metallurgical laboratory in Quincy, Ill., according to Industrial Plastic Fabricators, Inc.

A perchloric fume hood is a part of the laboratory's exhaust system, which is designed to overcome the hazardous and corrosive fumes emitted by perchloric acid when used in conjunction with the determination of silicon in ferrous metal alloys. Because of the corrosive conditions caused by the perchloric acid, the system lasted approximately one year with a limited use of perchloric acid.

The installation of the PVC equipment was specified for maximum corrosion resistance to perchloric acid. The installation of the washer was required in order to dilute the fumes of perchlorates which would be exhausted into the air and possibly settle on an asphalt-type roof, wherein an accumulation could possibly cause an explosive compound to be formed.

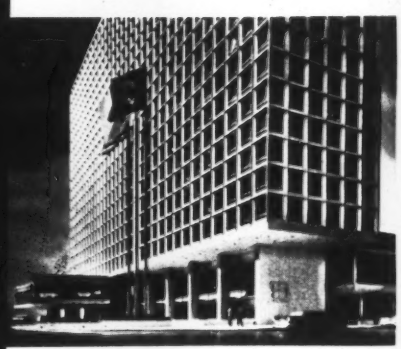
"Scientists Make it Known, Engineers Make it Work"

A SERIES of public service advertisements designed to create desirable understanding of engineers and engineering by printed media, radio and television, public officials, organizations, and advertising agencies have just been released, according to the Engineers Joint Council.

With the theme of "scientists make it known, but engineers make it work," the ads are planned to clear up existing confusion between "scientists" and "engineers," terms frequently used interchangeably.

Architect: William B. Tabler, New York, N. Y., Ductwork Fabricator: Limbach Company, Pittsburgh, Pa. General Contractors: Turner Construction Company, New York, N. Y.

USS Galvanized Steel Sheets make strong, low-cost ductwork in the new Pittsburgh Hilton Hotel



Ductwork for the new Hilton Hotel in Pittsburgh is being fabricated from USS Galvanized Steel Sheets by Limbach Company. Galvanized steel was specified for this job because of its strength and economy. USS Galvanized was selected because of its consistent high quality. Because USS Galvanized Steel Sheets are strong and rigid, lock joints stay tight—less soldering or riveting is needed. The rigidity of the steel reduces flutter and vibration and allows longer spans with fewer supports—this makes installation quicker and easier.

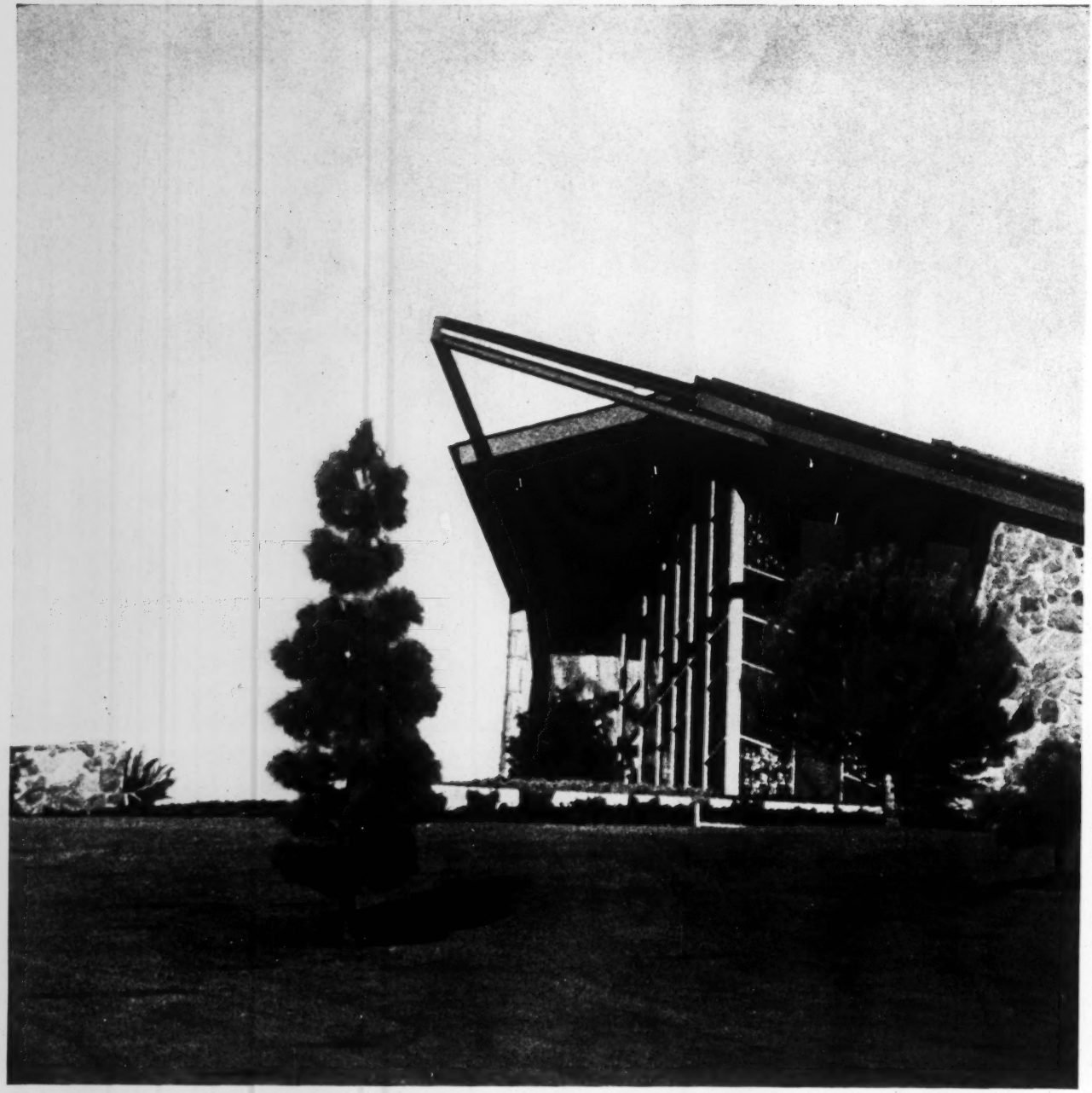
USS Galvanized Steel Sheets are easy to form. Even with severe shaping, the zinc will not flake off the base metal because USS Galvanized Steel Sheets have a tight, uniform bond between zinc and base metal.

Save money and improve the quality of your ductwork. Specify USS Galvanized Steel Sheets for your next job. USS Galvanized Steel Sheets are available from local steel service centers.

USS is a registered trademark

United States Steel Corporation – Pittsburgh
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
American Steel & Wire – Cleveland
United States Steel Supply – Steel Service Centers
United States Steel Export Company

United States Steel



Now we're cooling with **GAS**

A 22-foot wall of sheer glass... yet it's always cool inside! – thanks to GAS-operated Arkla-Servel air conditioning

The strikingly modern Hillside Church is one of four completely air-conditioned buildings in Rose Hills, Southern California's beautiful memorial park. Because of the liberal use of glass walls, and the desire for one central system, the air conditioning installation presented unique problems.

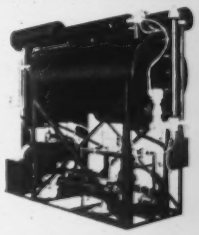
After a careful study, the Arkla-Servel gas absorptive cooling system was chosen. "And we're com-

pletely satisfied," says John D. Grigg, President. "Our 25-ton gas unit produces 10,000 cubic feet of cool air per minute. And you can't beat it for economy. It requires practically no maintenance. Since it uses the same boiler, it makes use of our heating facilities on a year-'round savings basis."

Gas absorptive cooling can put your heating plant on a year-'round economical basis too. For specific information, call your local gas company, or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. *American Gas Association.*

GAS OPERATED ARKLA-SERVEL
ABSORPTION-TYPE WATER CHILLER

- lowest operating costs
- fully automatic operation
- long dependable service
- packaged construction
- compact size
- easy installation



ALL SIZES, ALL BODY PATTERNS FOR ALL APPLICATIONS

BALANCED VALVES
— for air, steam, water, gas. Designed for applications where close control is required, where pressures exceed those of single-seated valves, and where tight closing is not required. Double-seated construction, approximately 98% tight closing. Sizes ½" to 14". Wide choice of models, capacities and operating features.

COIL VALVES
— for medium pressure steam, liquid, air or gas. Long-life molded rubber diaphragms. ½" to 6" sizes. Body patterns and features for many applications.

CONVECTOR VALVES
Compact size for installation in confined spaces, inside or outside convector enclosures. Models for low pressure steam, hot and cold water. All models have "Sylphon" metal bellows operators. Sizes ½" and ¾".

LIQUID VALVES
— for low pressure hot or cold water service. Choice of molded rubber diaphragms or seamless "Sylphon" bellows. Removable tops. Wide choice of features and body patterns. Sizes ½" to 8".

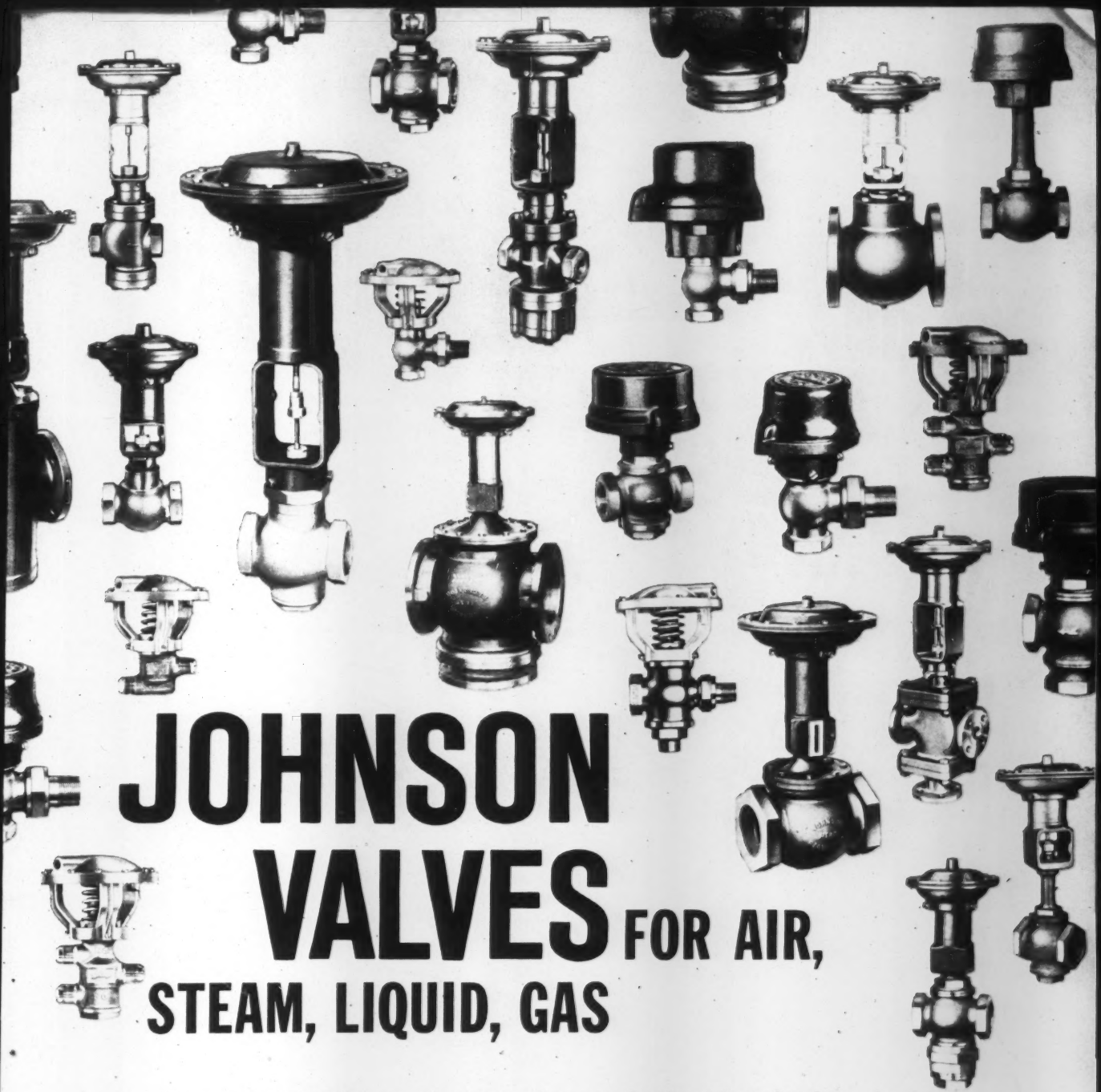
MIXING VALVES
— for applications requiring the mixture of liquids at different temperatures under control of a thermostat or humidostat. "Sylphon" and rubber diaphragm operators. Removable tops. Available in ½" to 10" sizes. Body patterns and operating features for every application.

BY-PASS VALVES
— for control of liquids over a wide range of temperatures and pressures. Sizes ½" to 6". Models available with 100% tight shutoff. Removable operators.

WATER VALVES
— especially designed for use with small room air conditioning and heating units. High grade bronze bodies. Rubber diaphragm operators. Corrosion resistant throughout. V-ring self-sealing packing assures positive seal. Renewable composition discs. Sizes ½" and ¾".

STEAM VALVES
— for control of low pressure steam. Rubber diaphragm or seamless "Sylphon" operators. Renewable composition discs especially compounded for steam service. Sizes ½" to 10". Choice of body patterns and features.

BRINE VALVES
— for control at pressures up to 50 psi. Cast iron or bronze bodies. Rubber diaphragm or "Sylphon" operators. Renewable discs, especially compounded for brine service. Removable tops. Sizes ½" to 8" in a variety of body patterns.



JOHNSON VALVES FOR AIR, STEAM, LIQUID, GAS

The specialized Johnson organization has exactly the right valve for every possible air-conditioning, heating, or ventilating control system application. In fact, Johnson makes the most complete line of pneumatic equipment in the industry — for solving any problem of temperature, humidity, or pressure control.

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PNEUMATIC SYSTEMS

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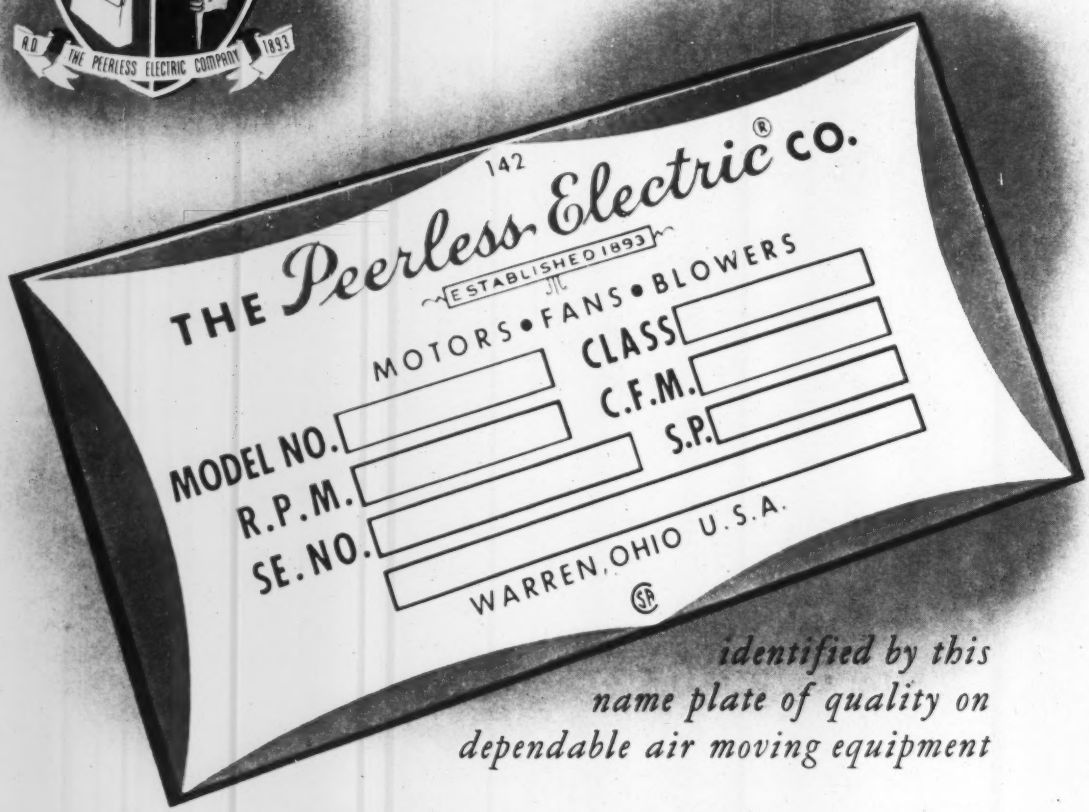
SERVICE · RESPONSIBILITY



identified by this name plate of quality on dependable air moving equipment

The incorporation of the Massachusetts Line® into the Peerless Electric product parade now makes it possible for Peerless Electric to supply fans and blowers with 4″ to 86″ wheels. Special units are being produced to customer, engineer, and government specifications every day. If you are an engineer, we suggest that you consider the specification of Peerless Electric Fans and Blowers. If you are a customer, you are assured that you are getting the best air moving equipment money can buy. If you are an installer, you will find that Peerless Electric products work in easily, quickly, and arrive at the job site completely ready for installation. Look for the name plate of quality — backed by Peerless Electric standards . . . knowledge . . . skill . . . service . . . and responsibility.

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THE Peerless Electric® COMPANY

Also Manufacturing The Massachusetts Line®

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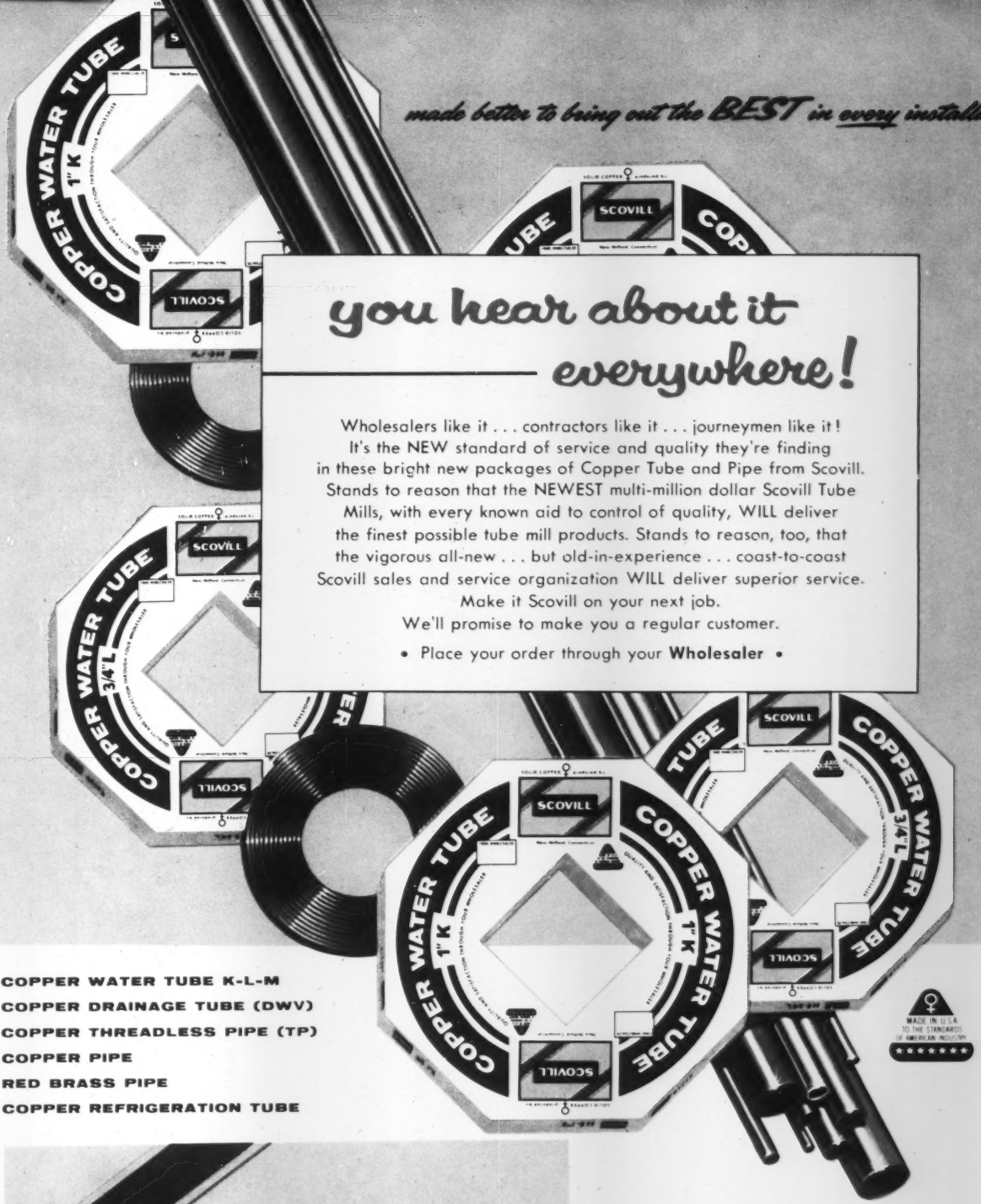
Member of the Air Moving and Conditioning Association, Inc. (AMCA)

made better to bring out the ***BEST*** *in* ***every*** *installation*



you hear about it — everywhere!

Wholesalers like it . . . contractors like it . . . journeymen like it! It's the NEW standard of service and quality they're finding in these bright new packages of Copper Tube and Pipe from Scovill. Stands to reason that the NEWEST multi-million dollar Scovill Tube Mills, with every known aid to control of quality, WILL deliver the finest possible tube mill products. Stands to reason, too, that the vigorous all-new . . . but old-in-experience . . . coast-to-coast Scovill sales and service organization WILL deliver superior service. Make it Scovill on your next job. We'll promise to make you a regular customer.

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COPPER DRAINAGE TUBE (DWV)
COPPER THREADLESS PIPE (TP)
COPPER PIPE
RED BRASS PIPE
COPPER REFRIGERATION TUBE

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

SCOVILL®

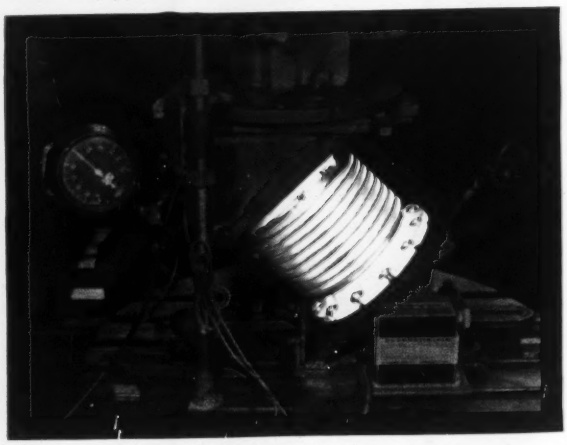
is the **new** standard in

copper water tube

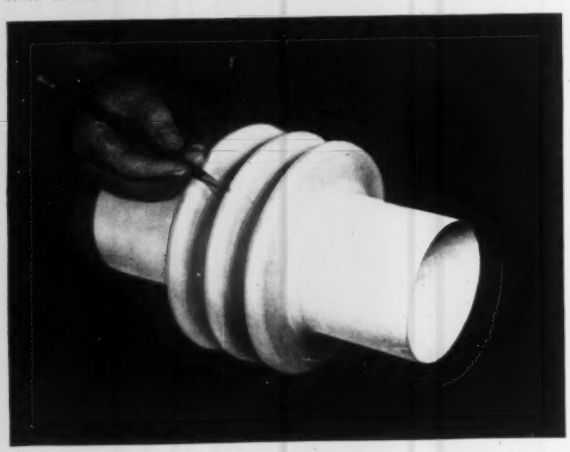
SCOVILL MANUFACTURING COMPANY • COPPER TUBE MILL PRODUCTS, WATERBURY, CONN.

4 WAYS to get maximum reliability in expansion joints

1 Insist that the corrugated bellows be hydraulically formed. The reason is simple. Whenever bellows are formed by circumferential welding . . . whether by edge, seam or fillet welding . . . they will always be subject to premature failure because of stress concentrations at the welds.



2 Be sure the manufacturer maintains a continuous and comprehensive program of endurance testing. This is basic, because of the many variables that affect expansion joint life. Accurate determination of expansion joint life expectancy can only be determined by cycling to destruction.



3 Demand proof that the manufacturer can produce longitudinal welds in the corrugated bellows having the same strength, physical properties and thickness as the parent metal . . . without grinding. A weld that is hard to find is a ground weld. Variations in weld thickness set up points of stress concentration . . . opening the way for premature failure.

4 Check the ability of the manufacturer to supply a team of *competent* design and application specialists to work with your engineers. Check their specific experience in handling critical, complex applications in your field . . . complete to the record of successes or failures behind them, and details of how this experience will be brought to bear on your problem.

At Zallea, none of the many factors affecting expansion joint reliability are left to guesswork . . . including the four vital ones above.

This is reflected in these facts. Zallea material specifications are the most exacting in the industry. Zallea expansion joints are hydraulically formed. Zallea advanced welding techniques insure welds having the same thickness, strength and physical properties as the parent metal. Zallea has done more cyclic testing to destruction than all government agencies and industrial firms combined. Zallea has produced more expansion joints than any other manufacturer . . . offers more application engineering experience.

For all the facts, write for Catalog 56. Zallea Brothers, Taylor and Locust Streets, Wilmington 99, Delaware.

Zallea for maximum reliability

ZALLEA BROTHERS, Wilmington 99, Delaware • World's largest manufacturer of expansion joints

HUSSEY COPPER

The Temperature-Sensitive Metal for Air Conditioning

THERMAL CONDUCTIVITY

Copper and the low-zinc brasses offer outstanding heat transfer rates. Hussey Copper and brass products have been recognized thermal material for 111 years.

CORROSION RESISTANCE

There's a Hussey copper alloy to meet most every corrosion problem; chemical, heat exchanger, processing equipment, refrigeration apparatus, etc.

STRENGTH

High-zinc brasses, nickel silvers, silicon bronzes and phosphor bronzes can provide tensile strength of up to 105,000 psi.

FORMING FACILITY

Hussey Copper has excellent hot and cold workability characteristics. Whether you bend, stamp, spin or machine, there's a Hussey copper to do your job.

JOINING

Hussey Copper and copper alloys lend themselves readily to soldering, brazing or welding by a variety of methods.

BEAUTY FINISH

Hussey copper is an attractive decorative material itself. It takes plating, anodizing, porcelain enamel and many kinds of finishes economically.

HUSSEY

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

C. G. HUSSEY & CO.

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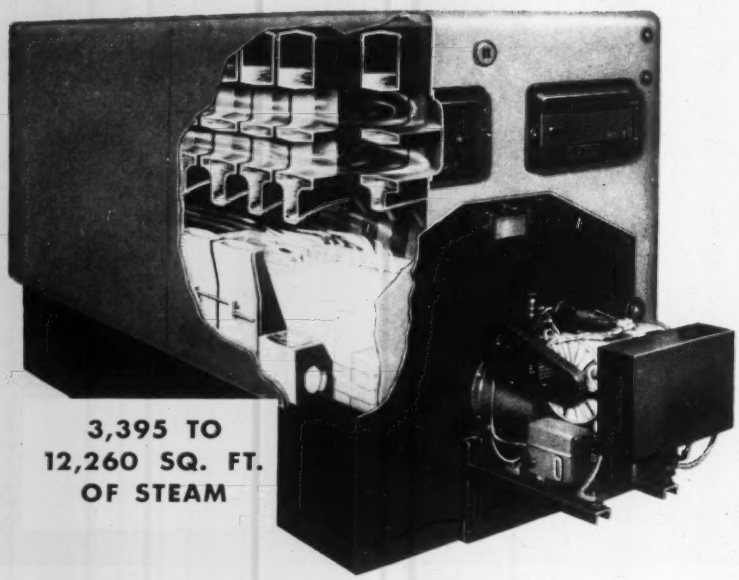
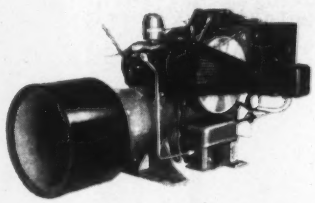
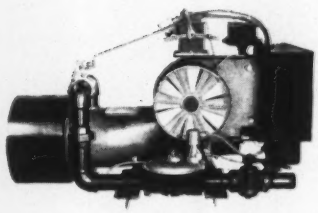
FIRST! CAST IRON BOILER-BURNER UNITS FOR No. 5 OIL OR COMBINATION GAS—LIGHT OIL



3,395 TO 12,260 SQ. FT. OF STEAM



Heavy Oil Burner



Combination Gas—Light Oil Burner

These Weil-McLain units are furnished with air atomizing, pressure type burners, completely integrated with electronic controls and factory-engineered combustion chamber design. The Oil Heating Units, while primarily designed to burn low-cost No. 5 oil, will efficiently handle all grades of lighter oils. The Combination Gas—Light Oil Units will burn either gas or No. 2 fuel oil.

Heavy Oil Burners

These burners furnish all the air needed for combustion. The accurately metered oil is intimately mixed with air into a highly combustible spray in the nozzle. Burners start with a small flame which gradually builds up to proper size. Safe operation is assured by electronic control.

Combination Gas—Light Oil Burners

Units consist of a power gas burner and a high pressure air atomizing burner, with high efficiency assured by correct metering of air and fuel. For both gas and oil operation, burner starts with small flame and builds up to required size. Electronically controlled with pre-purge and post-purge... manually or automatically changed from one fuel to another. Send for Bulletin C-272.

Burner service provided for one year, including start-up

For information on other Weil-McLain Gas and Oil Boilers, see Engineers' Product File or Sweet's Architectural File.

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ICH AND ICL 40 AND 44 BOILER-BURNER UNITS

FOR COMMERCIAL AND INDUSTRIAL HEATING SYSTEMS

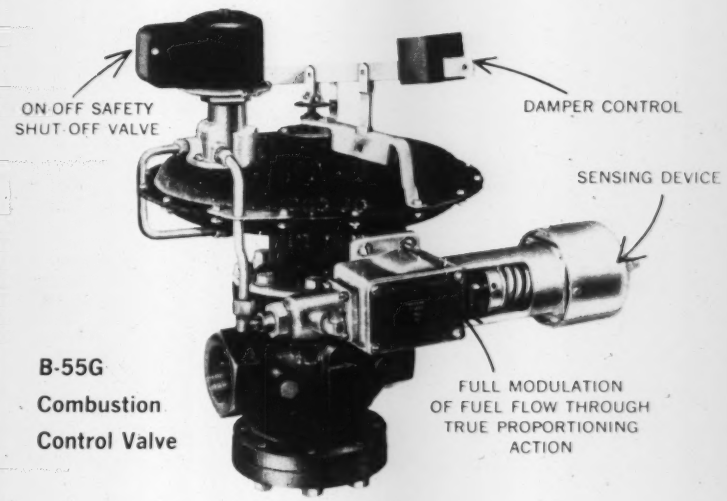
WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-89

for gas-fired boilers and furnaces...

A COMBUSTION CONTROL SYSTEM-*ALL IN ONE VALVE!*


ON-OFF SAFETY SHUT-OFF VALVE
DAMPER CONTROL
SENSING DEVICE
FULL MODULATION OF FUEL FLOW THROUGH TRUE PROPORTIONING ACTION

B-55G Combustion Control Valve

1. **Fuel Proportioning**
2. **Pressure or Temperature Sensing**
3. **Damper Control**
4. **Fuel Shut-Off**

Check the features to the left – then compare them item for item against *any* comparable combustion control system on the market. And to save yourself time and money, do it *before* you do that next installation or change-out. You'll find feature for feature, dollar for dollar, the General Controls B-55G is the best buy, every time. Immediate response to load changes in steam, hot water, or warm air systems – pressure and temperature ranges to 600 psi and 700°F. Sizes 1" to 6". Fully approved by AGA and UL. Let us send you complete information – or check the yellow pages for your nearest General Controls Factory Branch Office.

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AURORA®

Packaged

COND-A-PAC

CONDENSATION RETURN UNITS

Capacities to 15000 EDR–To 23 GPM

- Low NPSH . . . smooth ultra-quiet operation . . . impeller design with curved inlet blade tips that minimize shock loss as the liquid enters the impeller.
- Stainless steel shaft—rigid design eliminates shaft deflection and assures longer life for seal or packing.
- Stainless steel seals . . . maximum corrosion resistance . . . longer trouble-free life.
- High efficiency . . . low horsepower requirement . . . less power is needed to provide required delivery . . . less initial cost and lower operating expense.
- Utmost compactness — minimum floor space requirements.
- Low return—permits maximum flexibility of application.
- Rugged pump and receiver construction provides maximum long term top performance.
- Complete unit . . . ready for installation of lead lines.
- Self venting . . . will not vapor lock.
- Combination float switch and alternator optional when desired.
- Simplex or Duplex units.

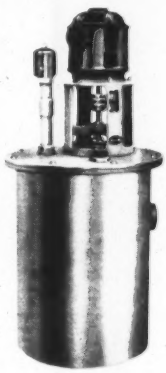
Aurora Pump specialists are always available for consultation on your requirements

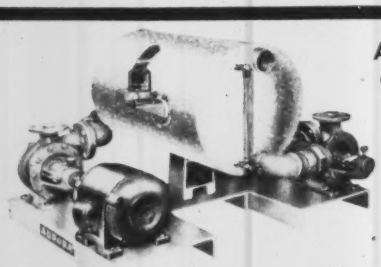
FOR GREATER CAPACITIES . . . OR SPECIAL CONDITIONS

VERTICAL UNITS

Capacities to 100,000 EDR 150 GPM

Ideal for applications where return is extremely low or below floor level.

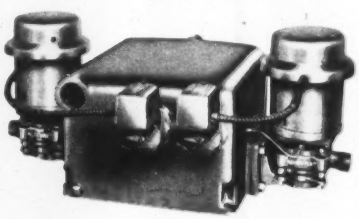




APCO HORIZONTAL UNITS Capacities to 100,000 EDR 150 GPM

With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS Capacities to 150,000 EDR 225 GPM



For high capacity or heavy duty applications. Packing Boxes on pumps optional when desired.

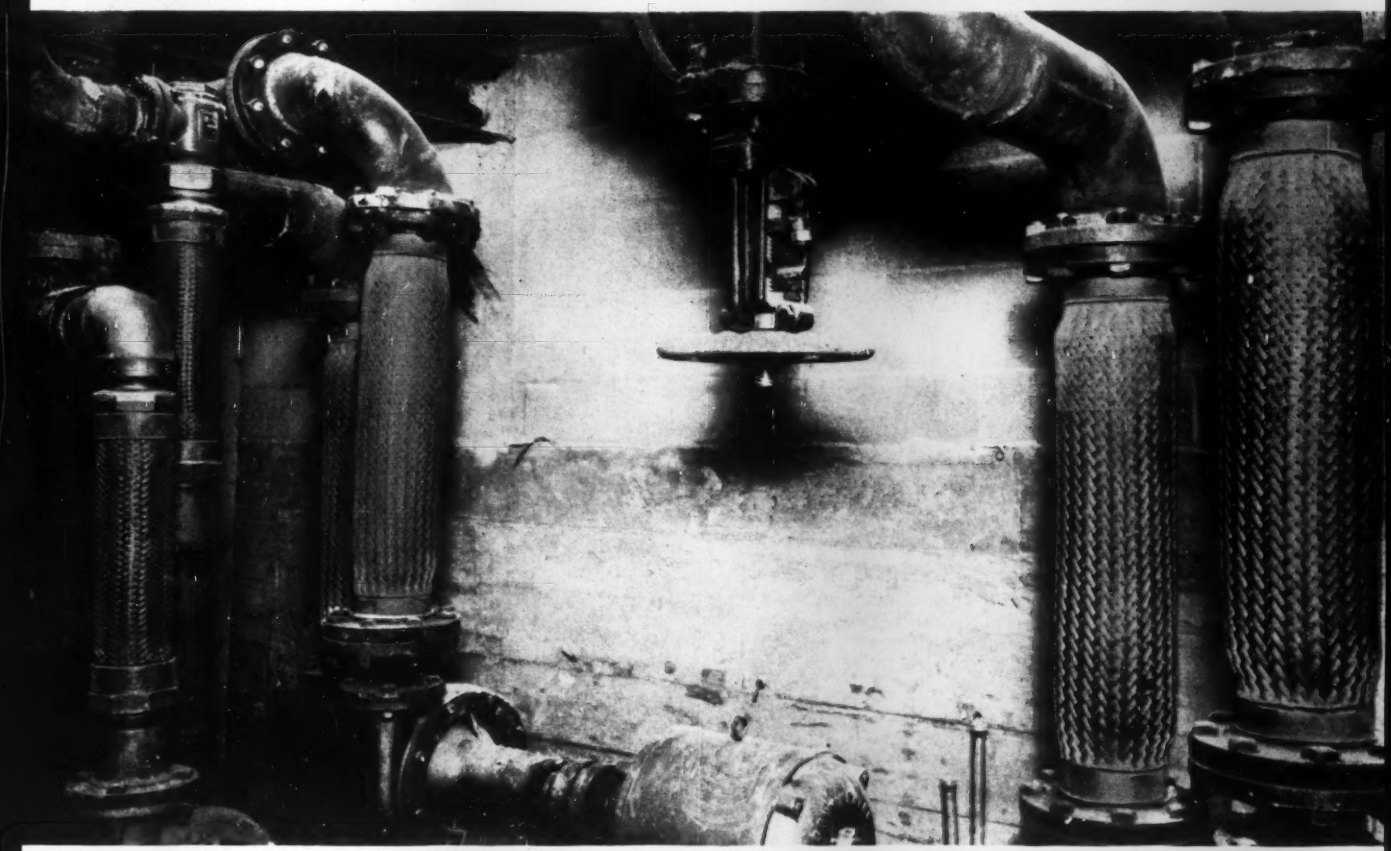
AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
650 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

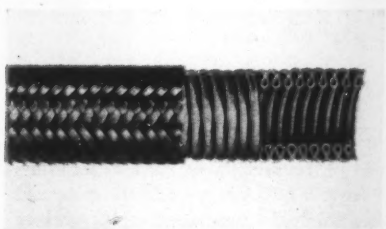
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®



Four 5-inch Flexpipe Connectors 30" long and four 3-inch Flexpipe Connectors 18" long connect pumps with hot water heating mains in big new Detroit Lakes, Minnesota, Senior High School. Architects: Traynor & Hermanson, St. Cloud, Minn. Engineers: Gausman & Moore Inc., St. Paul. Mechanical contractors: Holm Brothers, Atwater, Minn.

Flexpipe connectors handle expansion on long horizontal runs in big hot water job—eliminate vibration from pumps



FLEXPIPE'S flexible core can be either tin bronze, hot-dipped galvanized steel or stainless steel. End fittings (attached): flanges, threaded males and welding nipples.

The multi-structure design of many modern schools and institutions often makes necessary long horizontal runs for the heating mains. In hot water systems, it is very desirable, if not essential, to prevent transmission of vibration from the pumps to the mains. Flexpipe flexible connectors are designed for this service—will reduce pump vibration and noise.

Flexpipe connectors at the same time take up expansion and contraction in the mains. Thus in many cases they eliminate the need for expansion bends — make possible smaller, more economical tunnels—simplify and speed installation, reduce maintenance.

WHERE TO BUY:—Flexpipe connectors come in convenient standard sizes, are sold by leading distributors. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

5227 Rev.

Flexpipe® an ANACONDA® product

Bryant Manufacturing gets superior thermal and acoustical insulation with Pittsburgh Superfine Fiber Glass

HERE'S HOW BRYANT USES SUPERFINE IN ASSEMBLY LINE OPERATION . . .

1. Light-weight Pittsburgh Superfine is cut on an ordinary paper-type cutter to the correct panel size. No complicated equipment is needed. Superfine is ideal for fast, easy assembly line production methods.

2. Worker applies adhesive to panel with an ordinary roller in preparation for Superfine mounting. Bryant uses Pittsburgh Superfine Fiber Glass on four boiler models, five gas furnace models and two oil furnaces.

3. Pre-cut section of Pittsburgh Superfine is placed in panel, providing superior thermal and acoustical performance in the end product. Reflective properties of the Superfine's foil facing improve efficiency of the heating unit.

Mr. William M. Day, Vice President of Bryant Manufacturing Company, Indianapolis, Indiana, reports, "Besides passing our own rigid inspection standards, Pittsburgh Superfine has been tested and approved as an integral part of our products by the American Gas Association and Underwriters' Laboratory, Inc. We take no chances with the quality of our products, and that goes for the materials we put in them, too."

TAKE YOUR CHOICE OF SUPERFINE IN A VARIETY OF FACINGS

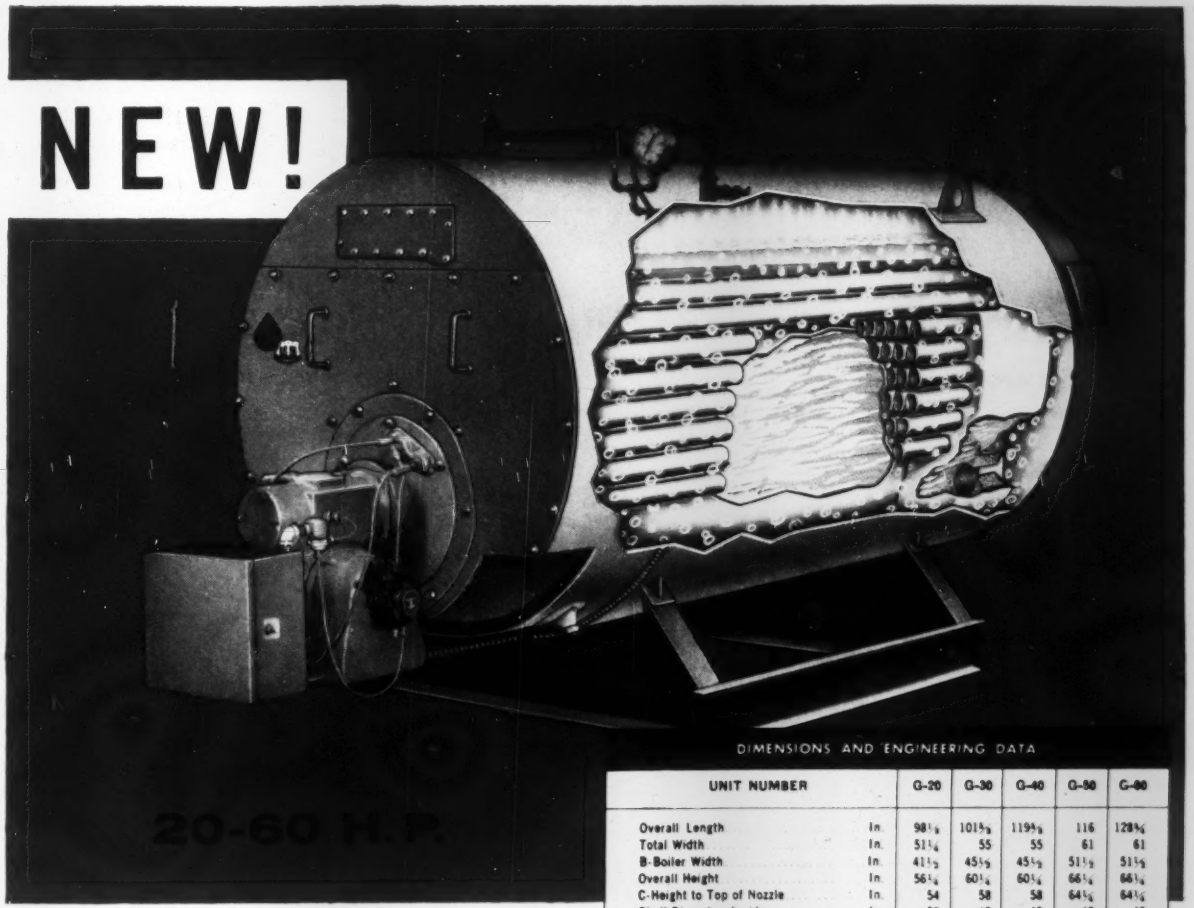
You can get top-quality Pittsburgh Superfine Fiber Glass Insulation in a wide variety of facings, each one designed for a specific application. For complete information, write to Pittsburgh Plate Glass Company, One Gateway Center, Pittsburgh 22, Pennsylvania.

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PG GLASS PITTSBURGH PLATE GLASS COMPANY

NEW!



DIMENSIONS AND ENGINEERING DATA

UNIT NUMBER		G-20	G-30	G-40	G-50	G-60
Overall Length	In.	98⅛	101⅝	119⅝	116	128⅝
Total Width	In.	51¼	55	55	61	61
B-Boiler Width	In.	41½	45½	45½	51½	51½
Overall Height	In.	56¼	60¼	60¼	66¼	66¼
C-Height to Top of Nozzle	In.	54	58	58	64¼	64¼
Shell Diameter, Inside	In.	38	42	42	48	48
Base Width	In.	41½	45½	45½	51½	51½
Base to Burner Front	In.	74½	76⅝	94⅛	85	97¾
Rear Overhang	In.	16	16	16	20	20
Supply Outlet Location	In.	49	49	49	52	52
Return Location	In.	7	7	7	7	7
Waterline Height	In.	44	47⅛	47⅛	52¼	52¼
Smokehood C.L. Location	In.	42¼	45⅞	45⅞	51¼	51¼
Smoke Outlet Diameter	In.	8	12	12	14	14
Clearance for Drawing Tubes	In.	50	53	70	66	80
Supply Outlet Size	In.	6	6	6	6	6
Return Size	In.	4	4	4	4	4
Recommended Vent Dia.	In.	8	12	12	14	14
Shipping Weight	Lbs.	2350	2750	3200	3700	4100

RATINGS & CAPACITIES

UNIT NUMBER	G-20	G-30	G-40	G-50	G-60
Net Rating, Steam (240 Btu) Sq. Ft.	2080	3120	4160	5200	6240
Net Rating, Water (150 Btu) Sq. Ft.	3328	4992	6656	8320	9984
Net Rating, Mbh	499	749	998	1248	1498
Certified Output—HP	20	30	40	50	60
Certified Output—Mbh	670	1004	1339	1674	2008
Firing Rate, No. 2 Oil (140000 Btu/gal) gph	6	9	12	15	18
Firing Rate, Gas, Mbh	838	1255	1674	2093	2510
Safety Valve Capacity lb Steam/hr	670	1004	1339	1674	2008
Heating Surface—Sq. Ft.	100	150	200	250	300

THE *Bonnie Scot* PACKAGED GENERATOR

With the addition of the new *Bonnie Scot* line, National-U.S. now offers a complete range of low pressure boiler-burner units to approximately 500 H.P., Certified Output according to M.C.A.A. ratings. All of these new generators are "wet-back," with 80% minimum thermal efficiency because of a full five square feet of fireside heating surface per boiler horsepower. Available for gas, or oil, or gas-oil firing, with forced-draft burners that eliminate need for expensive stack or chimney.

- **Five Sizes**—20, 30, 40, 50, and 60 H.P. for single or multiple installation in new or existing buildings.
- **Completely Packaged**—Factory assembled, wired and fire-tested, and shipped as a unit.
- **Quickly Installed**—Requires only simple piping and power connection.
- **Water Heaters**—Factory installed service hot water heater coils available as optional equipment.

Send for complete specifications and engineering data, Form No. 1016.

• • •

The Bonnie Scot is rated in accordance with the requirements of the Mechanical Contractors Association of America.

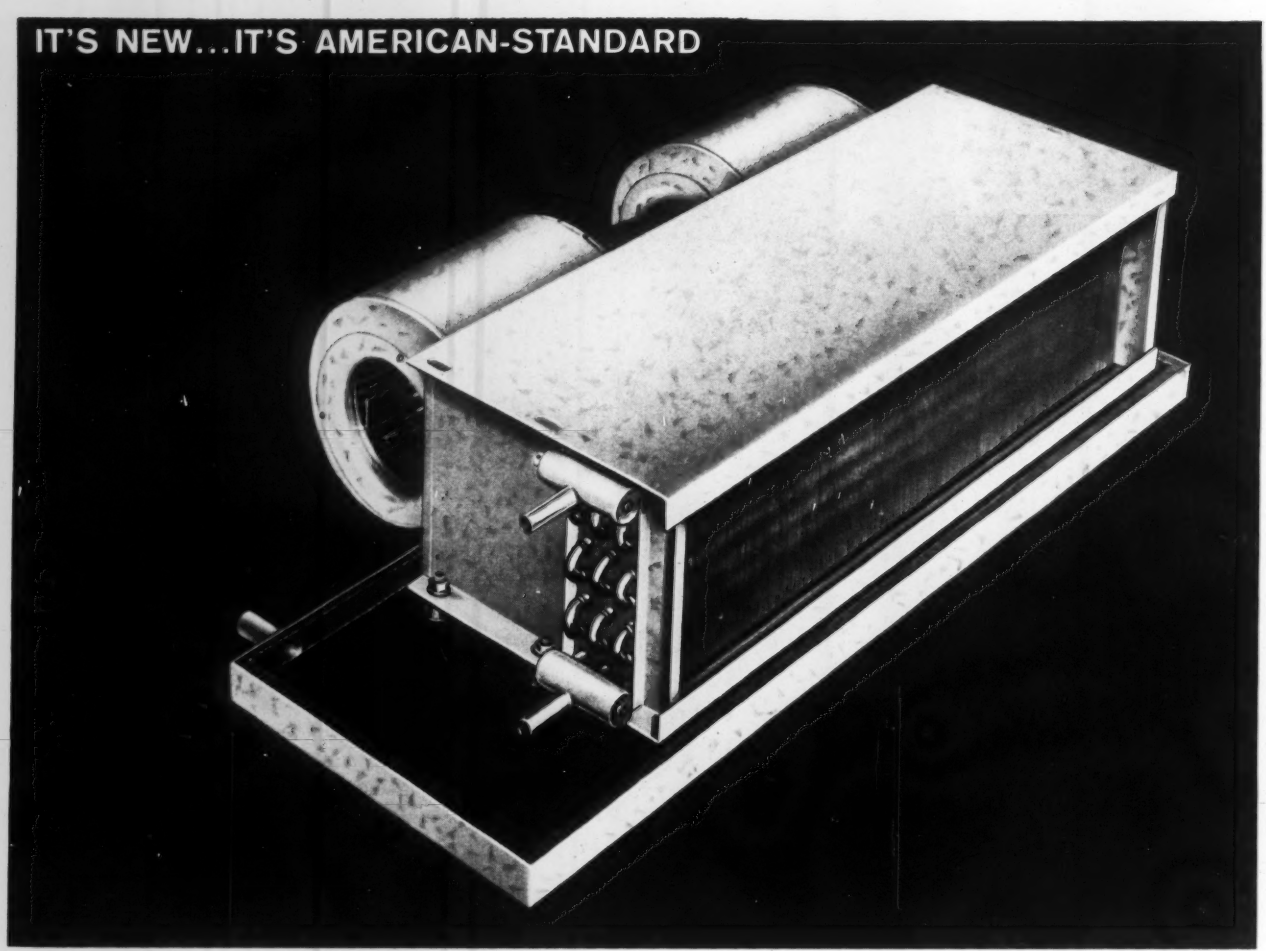
National-U.S. Radiator
CORPORATION

HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania
In Canada: 77 York Street, Toronto

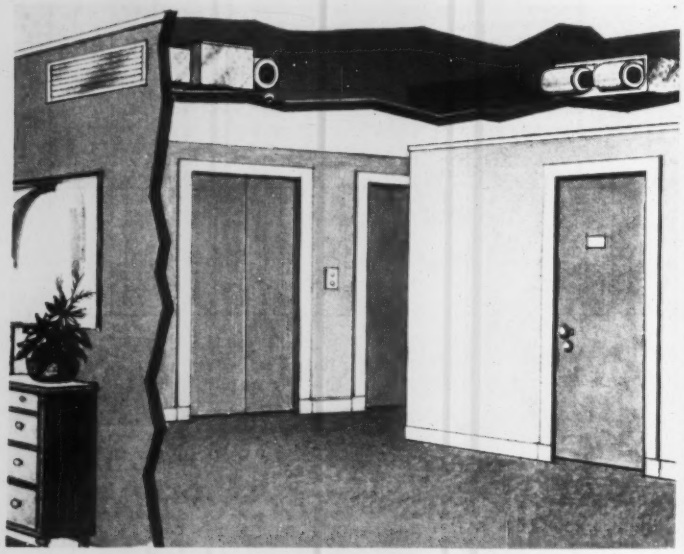
59-12

Sixty years in thermal hydronics

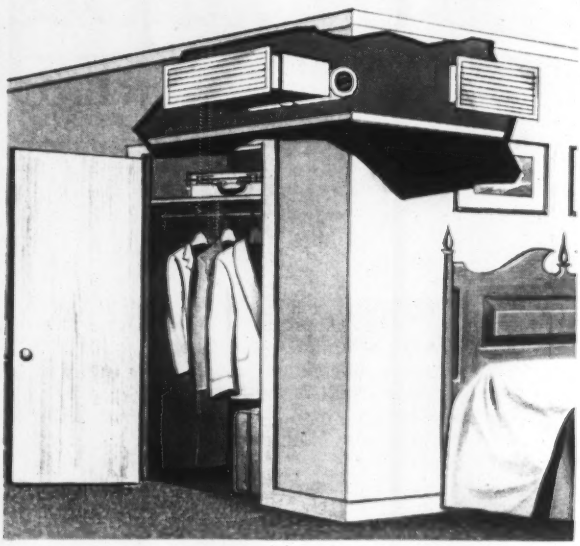
IT'S NEW...IT'S AMERICAN-STANDARD



New lightweight (39 to 69 lbs.) Type 30 Remotaire room unit is secured from overhead by four mounting hangers inserted in slots in top panel. Unit center of gravity is equidistant from mounting slots for balanced weight distribution, and level installation.



Corridor installation offers many advantages: units are completely outside rooms; fresh-air supply is from either end of corridor; installation easily concealed with hung ceiling.



Compact, concealed closet installation uses no floor or wall space—leaves an absolute maximum of usable space area, windows unblocked and complete decorating freedom

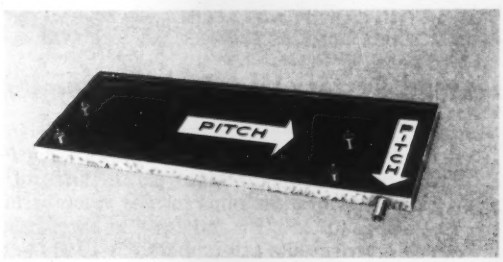
Before you specify any
year 'round air conditioning,
find out about the

NEW TYPE 30 REMOTAIRE

concealed overhead room units

When you're planning year 'round air conditioning for buildings in which floor and wall space are at a premium, flexibility of installation is important. In such installations you will find this new American-Standard unit is the economical ideal.

Flexibility of installation is designed into the Type 30 Remotaire. Compact, 10″ deep room units are easily concealed in dropped ceilings, closets and small furred-down areas. Balanced weight distribution and convenient electrical and piping connections simplify installation.



New drain pan with two-way pitch gives maximum sweat protection with condensate disposal over smooth, insulated free surface; no metal-to-metal contact with coil enclosure.

Flexibility of performance results from a selection of four capacity sizes from 200 to 600 cfm, each with three built-in motor speeds. Motors are matched to rated fan loads for quiet, economical operation.

This new hydronic system, of which Type 30 Remotaire units are a part, also features installation and performance flexibility. One set of small-diameter, space-saving pipes provides precise distribution of hot and chilled water from a remote boiler and chiller to each room unit.

For full description, see your American-Standard representative or write AMERICAN-STANDARD, PLUMBING AND HEATING DIVISION, 40 West 40th Street, New York 18, N. Y.

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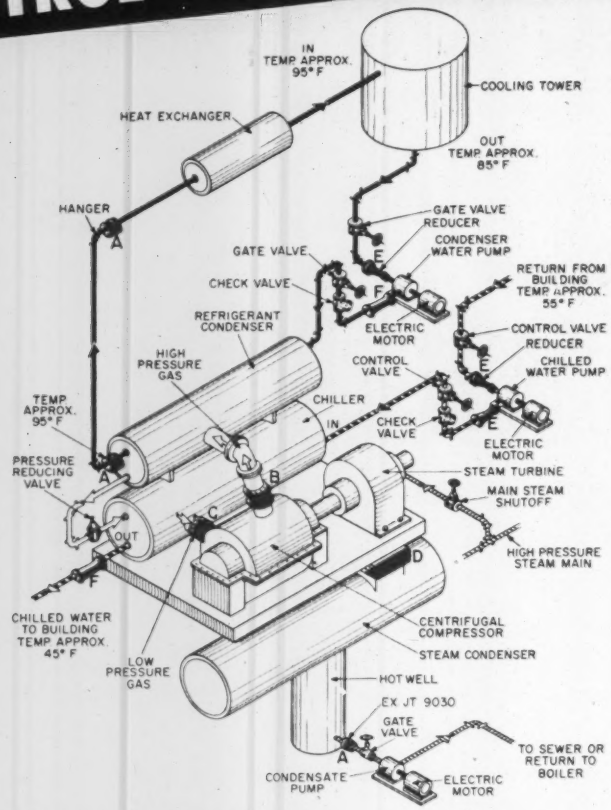
AMERICAN-Standard
PLUMBING AND HEATING DIVISION

HOW TO CONTROL VIBRATION & EXPANSION



La Favorite protection for these stress points:

A Expansion Joint 9060, standard duck and rubber, for use in pressure system, absorbs axial pipeline motion.

B Expansion Joint 9030, neoprene lined. For pressure, absorbs axial and transverse motion. Neoprene acceptable for refrigerant No's 12, 13, 114, 22.

C Expansion Joint 9015 with control unit, for vacuum service. Neoprene lined for refrigerant No.'s 12, 13, 114, 22.

D Expansion Joint 5030 or 4030, for pressure service. Absorbs oscillation. Internal or external flanges.

E vibrJoint LF15R, LF25R, absorbs vibration, eliminates purchase of metal increaser or reducer. Neoprene and duck.

F vibrJoint LF15 and LF25. Neoprene and duck, eliminates water hammer.

a steam-driven, centrifugal-compressor AIR CONDITIONING SYSTEM

One of a series

How Expansion and Vibration Joints Extend System Life, Reduce Maintenance

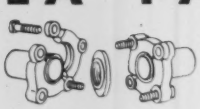
Modern air conditioning equipment, when properly installed, is designed to give long, maintenance-free service. To take full advantage of this equipment, your refrigerant and coolant pipeline systems should also be designed for long, efficient service. To do this, some basic problems common to most large systems must be solved. They are: (1) protection of the system from severe expansion and contraction, (2) absorption of pump and compressor noise, (3) protection of pipelines from misalignment and fracture caused by settling, and (4) protection of the system from electrolytic corrosion.

These problems can be solved through planned use of expansion and vibration joints. La Favorite designs and manufactures a full range of expansion and vibration joints for use in temperatures of —40° F to 250° F, and for handling brines and such refrigerants as numbers 12, 13, 114, and 22.

La Favorite expansion and vibration joints are a sound investment, whether incorporated into your system during the design stage, or used to modernize existing systems. More complete information on La Favorite products and engineering services is available on request. Write for Bulletin 982.

LA FAVORITE RUBBER MFG. CO.

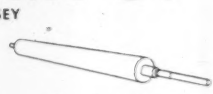
256 WAGARAW ROAD, HAWTHORNE, NEW JERSEY


FIELDLINK®

FABRICATED PVC

PROCESSING EQUIPMENT

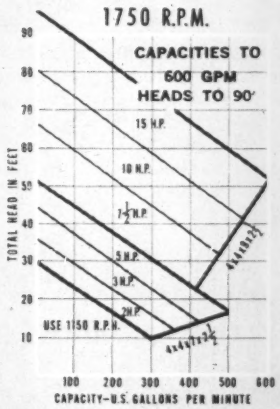
MOULDED GOODS


RUBBER COVERED ROLLS

PNEUMATIC GASKETS

YEOMANS NEW SUBMERSIBLE

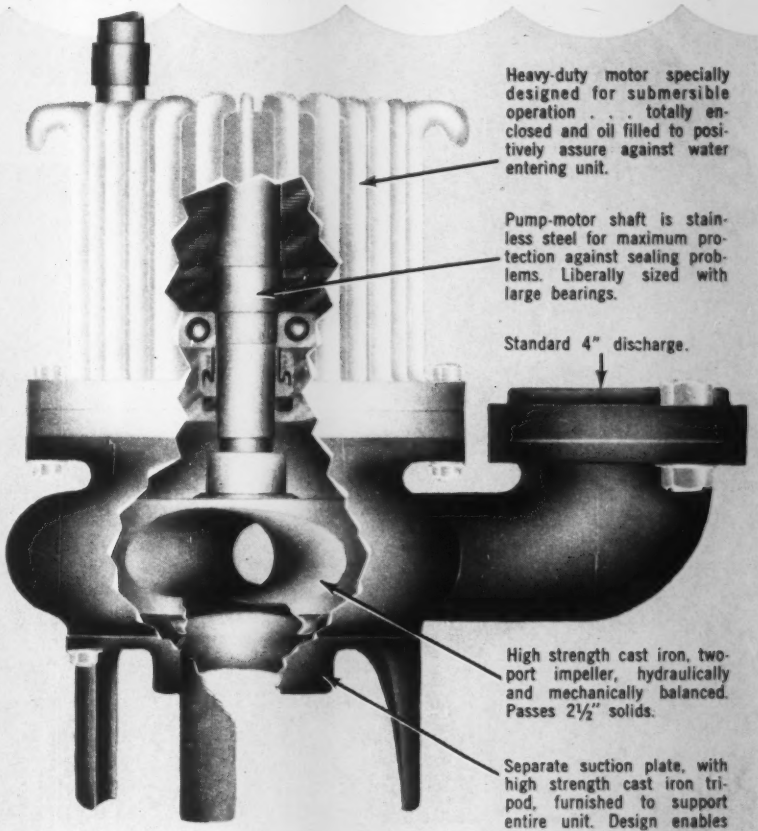
Nonclog sewage and drainage pump— Series 9000



APPLICATIONS — Commercial and industrial buildings, processing plants, utilities, sewage plants, water treatment facilities, recreation parks and pools.

AUTOMATIC CONTROLS — Heavy-duty float switch with float and rig, or electrode control. In duplex installations, Yeomans "Interchanger" equalizes wear between the two pumps by alternating operation. In addition, the "Interchanger" starts the pump not in use when peak conditions call for extra capacity.

Complete details available from your Yeomans representative, or write the factory for Leaflet 9001.



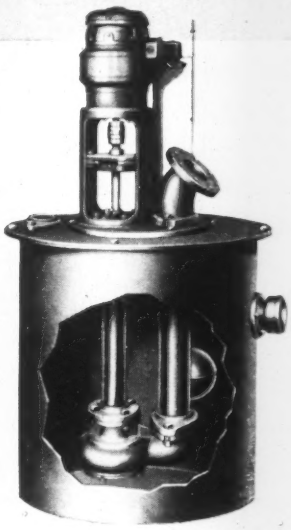
Heavy-duty motor specially designed for submersible operation . . . totally enclosed and oil filled to positively assure against water entering unit.

Pump-motor shaft is stainless steel for maximum protection against sealing problems. Liberally sized with large bearings.

Standard 4" discharge.

High strength cast iron, two-port impeller, hydraulically and mechanically balanced. Passes 2½" solids.

Separate suction plate, with high strength cast iron tripod, furnished to support entire unit. Design enables easy, quick access to impeller.



SEWAGE AND DRAINAGE PUMPING CALLS FOR A SKILL OF ITS OWN

Vertical wet pit pump jobs are as individual as people. Each sewage and drainage job demands a certain type of unit, materials, packing, lubricants, bearings, and speed. If these variables are not properly combined, pump performance and life suffer.

Here's where Yeomans' 61 years of service to the building, industrial, and processing fields is invaluable. Here's where the "calculated feel" and know-how of Yeomans engineering pays off in extra long pump life and low maintenance.

On your next sewage and drainage jobs, ask for recommendations from the industry's leader. Call in your Yeomans representative and **be sure.** He's a specialist with a complete line of waste handling pumps. Look in Sweet's Catalogs or the yellow pages of the phone book.

YEOMANS

2000-5 North Ruby Street, Melrose Park, Illinois

P-5922

HOW A CLOSER LOOK AT GAUGE BUYING TODAY...

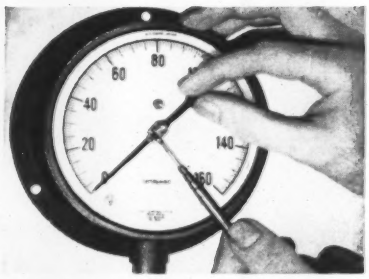
can help cut your gauge maintenance costs

Been taking gauges pretty much for granted? As to the price you pay, accuracy you buy, performance you get . . . gauges you use and their maintenance costs? Maybe it's time for a closer look at the United States Gauge line and how it can streamline buying. USG features the most comprehensive line of indicating dial pressure gauges you can draw on . . . in range of case styles, materials and sizes, in pressure ranges and in price . . . up to the finest gauges money can buy. The *completeness* of the USG line can help you avoid over-buying, under-buying, help you get exactly the gauge performance you pay for . . . from one source! As shown at right, exclusive USG design features even help cut maintenance costs. Check your USG distributor for your next gauge requirement. See the Yellow Pages, or write for catalogs and name of your nearest USG distributor, today.

UNITED STATES GAUGE

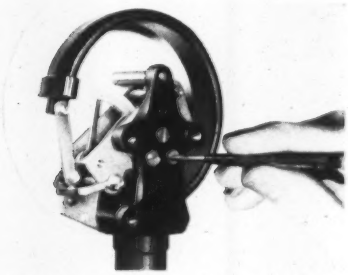
Division of American Machine and Metals, Inc., Sellersville, Pa.

Find Your Nearest Distributor in The Yellow Pages



NOTE that with a USG Supergauge®, complete recalibrations can be made faster than with any other process gauge. For example: "zero shift" adjustments are made from the front with gauge in operating position, and without removing pointer from the shaft.

NOTE that with USG Mono-Unit design, internals are in one assembly which lifts out intact. Legend on dial gives full information for instant identification of model number and materials in components. More maintenance minutes saved!



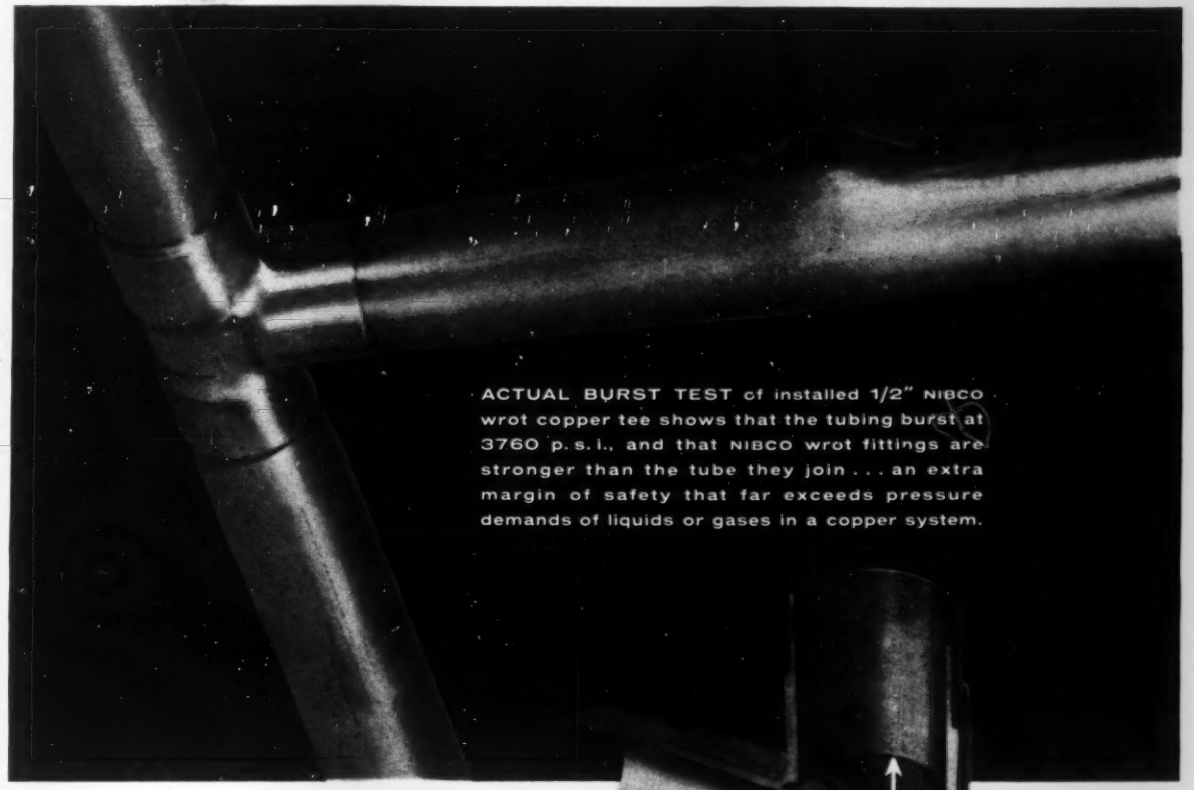
NOTE that with USG Arc-Loc® movement, corrections for "scale shape" (linearity) errors and "range" adjustments are both made from the rear; no need to remove pointer and dial. USG's unique locking method eliminates creep during locking, saves more time! USG Supergauges meet A.S.A. standards for Grade AA Test Gauges, including accuracy to ½ of 1%. *Write for Catalog 1819.*

SAVINGS IN USG A-LINE, TOO!

Premium gauge construction at savings up to 40% of premium prices! Major economies in pressure measurement where you may now be buying more gauge than you need! Meets A.S.A. Grade A standards, including accuracy of 1%. Wide choice of options. Has Supergauge Mono-Unit design—cuts recalibration time. *Write for Catalog 305.*

When you compare copper fittings...

remember David and Goliath!


ACTUAL BURST TEST of installed 1/2" NIBCO wrot copper tee shows that the tubing burst at 3760 p.s.i., and that NIBCO wrot fittings are stronger than the tube they join . . . an extra margin of safety that far exceeds pressure demands of liquids or gases in a copper system.
ZONE OF STRENGTH

Like David of old, NIBCO wrot copper fittings are strong where it counts. Wall thicknesses in the NIBCO "zone of strength" (as shown in the cutaway tee, for example) are not made to the "L" minimum ASA standard, but have heavier than "K" wall thickness of metal... additionally densified in processing. This is but one reason why NIBCO fittings are specified by the nation's leading contractors and service organizations. See your NIBCO wholesaler, or send coupon for ***FREE CATALOG.***

NIBCO

NIBCO INC.—Dept. J-6408, Elkhart, Indiana

Please send "Catalog I" of NIBCO fittings.

name _____

firm _____

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Choice of the leaders: K&M high-pressure insulations

Where temperatures range up to 1350°F., you'll find leaders in all fields where heat control is important turning to "K&M" KaytherM. Because they can be *sure* with "K&M" KaytherM. There's no better insulation of its type. In low-pressure insulations, it does everything "85% Magnesia" does, and does it better. Composed of diatomaceous silica and quality asbestos fibers, "K&M" KaytherM is easily worked on the job, chemically stable, strong, and lightweight. Cement adheres readily.

"K&M" also manufactures a full line of Low-Pressure Insulations in pipe, sheet, and block forms, as well as in cements for all types of applications.

Whatever your insulation problems, you can rely on the eighty-five years of asbestos engineering that lies behind every "K&M" asbestos product.

KEASBEY & MATTISON
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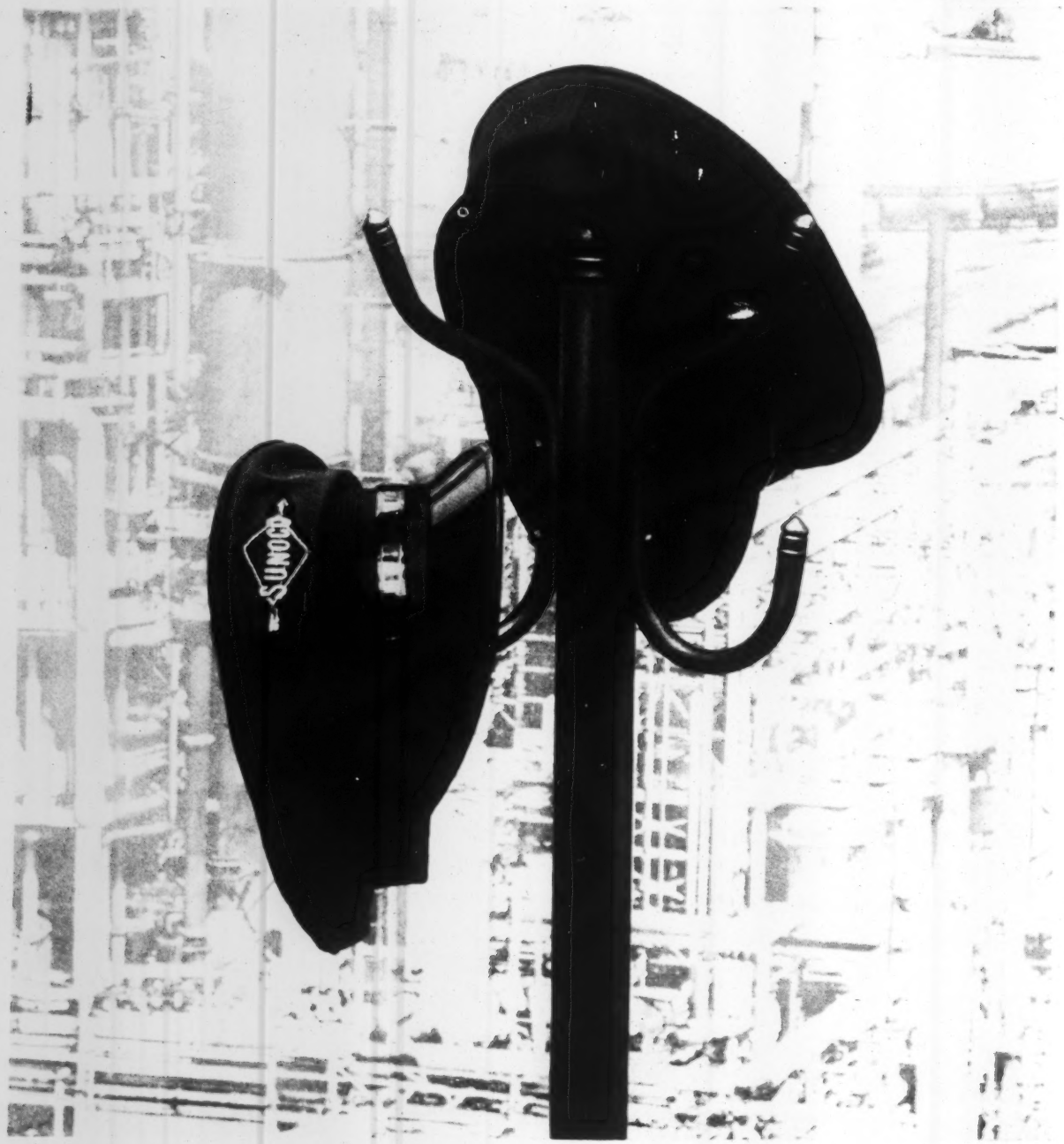
K·M
BEST IN ASBESTOS

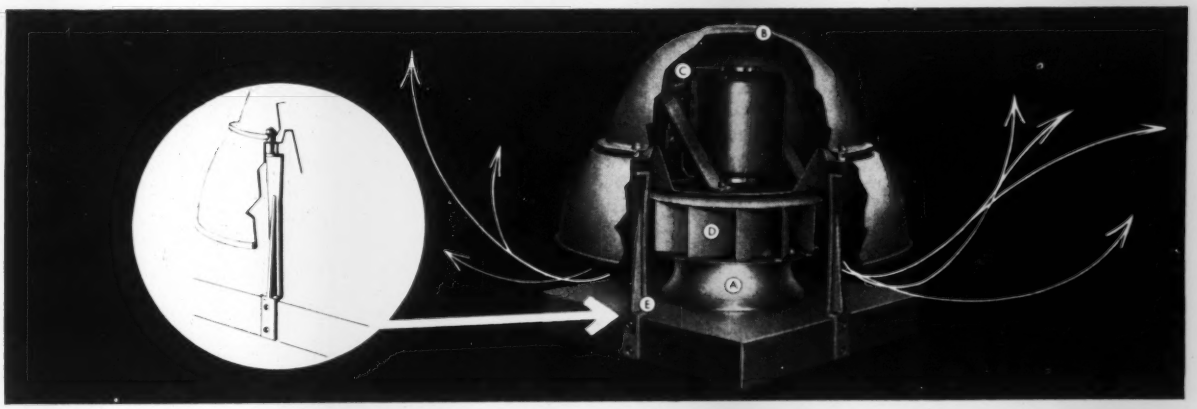


COMPARE EXITAIRE

curb-mounted brackets for extra rigidity

another superior feature of **Exit Aire**

the complete line of power roof ventilators



Exit Aire exhausters welcome feature-by-feature comparisons because they demonstrate so well why EXIT-AIRE gives the finest ventilation at modest cost.

Compare the performance features of the EXITAIRE with those of any other ventilator. Take CURB-MOUNTING, for example...

The EXITAIRE unit is solidly suspended by 4 sturdy cast-aluminum brackets attached directly to the curb. Compare with units which have dissimilar metal vibration mountings resting directly on spun aluminum housings, subjecting the units to electrolysis between the dissimilar metals, which may cause deterioration or collapse. With EXIT-AIRE, the motor compartment is insulated from vibration to curb by individual Neoprene "sandwich" dampeners for silent vibrationless operation! Motor is resiliently mounted. No need for rubber curb mountings.

feature by feature—compare ExitAire:

A. NEW "AIRE-FLOW" INLET CONE similar to centrifugal blower-type for maximum efficiency, with air turbulence reduced to a minimum. Allows use of smaller wheel which is quieter in operation and easier to balance.

B. LOW SILHOUETTE conforms with modern architecture!

C. DISCONNECT SWITCH provided for mounting in motor compartment. Standard on single speed unit 10" and larger.

D. NEW WHEEL DESIGN delivers more capacity, per HP rating, than conventional wheels! Small size enhances balance.

E. COMPLETE CURB-MOUNTING! An *integral* part of unit, no extra cost!

EXITAIRE GIVES YOU CERTIFIED PERFORMANCE RATINGS, TOO! ExitAire Power Exhausters carry the Certified Rating Seal of the Air Moving and Conditioning Association... Underwriters' Laboratories, Inc. listing on most power units. You can be *sure* when you specify ExitAire!

compare—you'll buy ExitAire

Exit Aire COMPANY

P.O. BOX 276, PACOIMA, CALIFORNIA

ExitAire Company
P.O. Box 276, Pacoima, California

Please send me by return mail your Bulletin 659, A.I.A. File No. 12K2, with complete specifications and engineering data on ExitAire. There is no charge or obligation.

Name_____

Company_____

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City_____ Zone____ State_____

CONNOR . . .

ENGINEERING CORPORATION

Where "ENGINEERING ASSISTANCE at NO OBLIGATION" has REAL meaning

In more than a quarter century of service to hundreds of customers, Connor has lived up to claims for its products and service. Common problems of equipment selection have been solved simply by advice from a competent Connor sales engineer. Occasionally, such as it was here at Reynolds, the problem has been a somewhat more knotty one; and proof of the Connor equipment's superior suitability required more extensive presentation . . . an exacting pre-installation display of functional capability.

These are the occasions when Connor gives its offer of "engineering assistance without obligation" real meaning. For the Reynolds job, Connor presented a theory, and willingly, without obligation, proved its practicality in a pre-job test; and on the strength of test results, guaranteed their equipment's satisfactory on-the-job performance.

Connor is ably represented throughout the United States and Canada. Before your next air conditioning job, ask for the name of the Connor man nearest you . . . and at the same time, ask for a reprint of the article which fully describes the revolutionary Reynolds installation.

Until engineered by Connor, diffuser installation above ceiling was thought to be unworkable.

In consultation with engineers on the Reynolds job, Connor painstakingly presented its unique air distribution theory . . . which would enable installation of diffusers, ductwork, and return air intakes *above* an aluminum honeycomb ceiling.

To demonstrate the positive, satisfactory performance promised in theory, Connor, on its own initiative, erected a typical module of the Reynolds building in the Connor laboratory. Expected on-the-job conditions were duplicated exactly. Excellent room air mixing was obtained. 74 F was the test room's lowest temperature point, 76 F its highest.

As illustrations show, diffusers, return air intakes, lights are concealed above aluminum honeycomb ceiling. Arrangement does not impair air distribution.

CONNOR . . . for Constant Comfort Conditions

CONNOR ENGINEERING CORPORATION

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kno·draft®

air diffusers

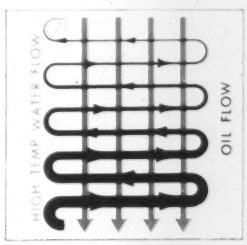
HOW TO USE
high temperature water directly in a no. 6 oil heater–with no danger of system contamination!

The unique Paracoil "Thermo-Film" heater permits *direct use of HTW in the same heater shell with the fuel oil.* The "Thermo-Film" design provides all necessary circuit isolation. This means smaller space requirements, simpler operation and lower installation costs than alternate methods using intermediate exchangers with inter-connecting piping, regulators, level controls, etc.

COMPLETE ISOLATION of HTW and fuel oil is accomplished by a coaxial tube assembly, with heat-transfer liquid separating inner and outer tubes. *Boiler contamination in the event of oil tube failure is impossible.*

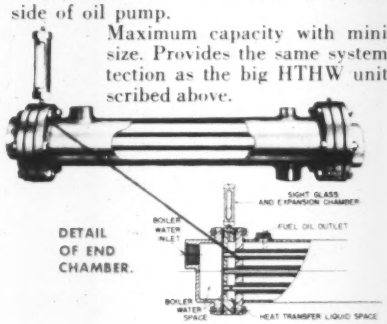
EXTENDED SURFACE of outer tubes substantially reduces size and weight of heater.

INTERNAL TURBULENCE —with oil baffled back and forth across heating tubes— increases heat transfer rates and reduces bulk of the heater.



ALSO–LOW PRESSURE MODELS
Compact units using low pressure boiler water, for installation on suction or discharge side of oil pump.

Maximum capacity with minimum size. Provides the same system protection as the big HTHW units described above.

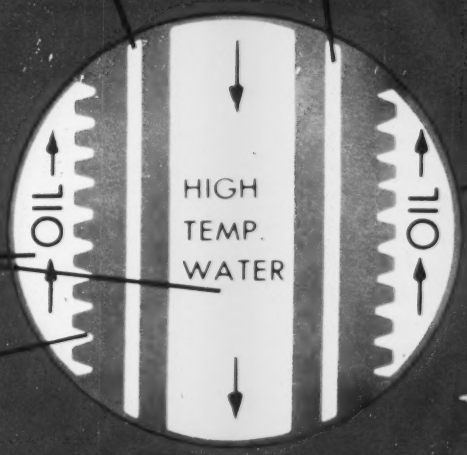


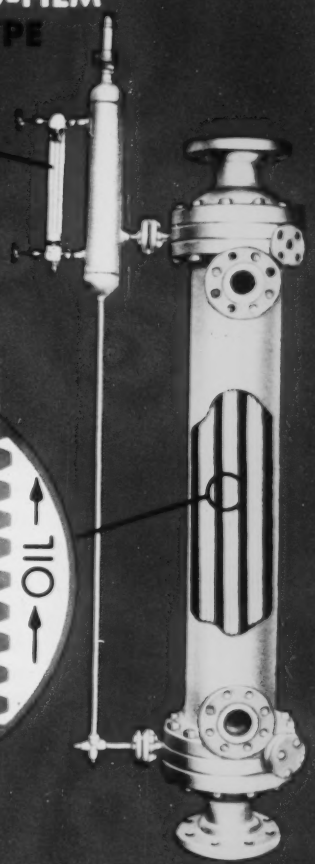
TURN PAGE FOR ADDITIONAL DESIGNS OF PARACOIL FUEL OIL HEATERS — YOU MAY HAVE BEEN LOOKING FOR ONE OF THEM!

PARACOIL "THERMO-FILM" SAFETY BARRIER TYPE FUEL OIL HEATER–

SIGHT GLASS immediately reveals presence of oil in heat transfer liquid system in the unlikely event of a leak.

THERMO-FILM* The safety barrier heat transfer liquid, extremely thin for maximum heat transfer.





STRAIGHT TUBE CONSTRUCTION GIVES 100% COUNTERFLOW.
Heated oil exits at end where HTW enters at its highest thermal head—another feature assuring maximum heat transfer.

High pressure models for HTHW installations on discharge side of pump

DAVIS ENGINEERING
A DIVISION OF AMERICAN METAL PRODUCTS CO.
520 MAIN AVENUE, WALLINGTON, N. J.

*Reg. U.S. Trade Mark

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DAVIS ENGINEERING
(A Division of American Metal Products Company)
520 MAIN AVENUE
WALLINGTON, N. J.

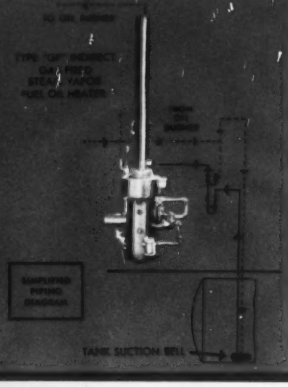
which of these **fuel oil heating problems** can Paracoil help you solve?

UNDERGROUND STORAGE

Virtually all underground fuel oil storage problems are solved by this new Paracoil Type "VUF" Vertical Tank Suction Heater. It inserts into the tank vertically through a standard manhole, leaving all piping connections accessible outside the tank. Tube bundle can even be removed from a full tank—without breaking oil piping. Model shown is for use with hot fluids under forced circulation. Other designs are available using high pressure steam as the heating medium.

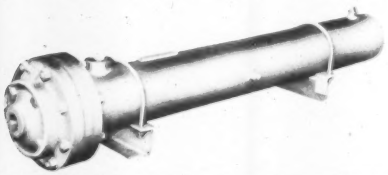
INTERMITTENT PLANT OPERATION

During plant shutdowns (weekends, for example), the Paracoil Type "GF" indirect gas-fired fuel oil heater system maintains proper temperatures in your fuel oil circuit. It uses low cost gas rather than more expensive electricity. The gas, which is kept isolated from the oil tubes, generates a supply of low pressure steam to heat the oil. When the main boiler resumes operation, a steam evaporator takes over the fuel oil heating, and cuts out gas operation.



HIGH CAPACITY OUTPUT IN LIMITED SPACE

This famous Paracoil Tubular Fuel Oil heater, using steam as the heating medium, provides remarkably high heat transfer rates. Space requirements and weights are at a minimum.



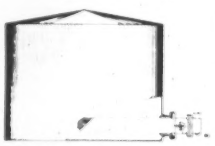
SUB-WATER LINE OR STEAM SYSTEMS

The Paracoil U-Tube type Fuel Oil Heater has been a standard of the fuel oil heating industry for years, can be used for sub-water line or with steam. Features a 6-pass design for the discharge side of the oil pump—a 2-pass design for the suction side.

DAVIS ENGINEERING
(A DIVISION OF AMERICAN METAL PRODUCTS CO.)
520 MAIN AVENUE, WALLINGTON, N. J.

PUMPING VISCOUS NO. 6 OIL FROM STORAGE TANKS

Tank suction heaters are used to lower the viscosity of No. 6 fuel oil before it enters your circulation system. Reduces strain on the pumps. For economy of operation, only the oil being withdrawn is heated—not the entire tank contents.

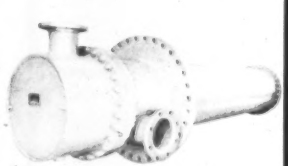


Tank Suction Bell Heaters

For small-to-moderate demand installations. Easily inserted through standard 16" tank manhole. Available in two sizes, 6 sq. ft. and 12 sq. ft. heating surface.

Horizontal Tank Suction Heaters

For higher capacity installations. Various designs to suit your own application. Model shown carries flange at inlet end for seal-off valve permitting removal of tube bundle from a full tank.



DAVIS ENGINEERING
(A DIVISION OF AMERICAN METAL PRODUCTS CO.)

HPAC

Please send me information and specifications on the following fuel oil heaters:

- ☐ THERMO-FILM HEATERS (see reverse side of this page)
  - ☐ High pressure model
  - ☐ Low pressure model
- ☐ Tank Suction Heaters
- ☐ Tubular Fuel Oil Heaters
- ☐ Type GF Indirect Gas Fired Heater
- ☐ U-Tube Fuel Oil Heaters

My application is_____

Name_____

Title_____ **Dept.**_____

Company_____

Address_____

City_____ **State**_____

MAIL THIS CARD for information and specifications on any heater shown on this page

"open for discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Nickel Mine Recovery Heat Exchange System Is Unique Ventilation Design

THE INGENIOUS system of ventilation described in the article, *Heat Outdoor Air for Nickel Mine by Recovery Heat Exchange System*, by Jas. G. Rutherford (May), is indeed unique.

It is interesting to note that at the maximum depth of 5425 ft the temperature of the rock is 124 F based on a temperature gradient of 30 C per km.

The installation of the supply and exhaust fans underground is unusual. Air supply pulled through the surface pit formed by the underground caving process is probably drawn through prepared vent openings. Presumably drawing air through the cave debris develops considerable resistance and during periods of thaw the pits would have impounded water.

The exhaust from the deep mine areas is described as "moving upward through the stoping blocks" indicating probably a number of rooms with timbers remaining intact after the ore has been removed. Timbers left underground have a rather high rate of deterioration particularly where moisture conditions prevail. Rotting adds to the normal underground temperature and reduces oxygen of the air in such areas.

Where Mr. Rutherford speaks of air return in a "raw airway that extends to the surface," I presume the opening has rough solid rock walls. This is indeed a most interesting system wherein the excess heat from the lower levels is used to warm the cooler upper workings by means of a heat exchanger. It is too bad that the return air from the lower levels cannot be exhausted directly as supply to the upper levels and eliminate the heat exchange and pumping operation. Moisture could be reduced in the lower level return by means of an adsorption stage, but undoubtedly the underground blasting operations seriously affect the quality of the air return. Mr. Rutherford no doubt discarded this possibility because of conditions at the mine.

The heat transfer system as described is most effective and flexible so that it can be adjusted to weather variations. Considering that the underground exhaust from most mines is wasted to the atmosphere, this installation is indeed a credit to the management in more ways than one.

LESTER S. RIES
Consulting Engineer

THE AUTHOR'S REPLY — We appreciate the comments of Mr. Ries. They are most interesting and warrant reply.

The virgin rock temperature at depth of 5425 ft at Creighton is 91 F. The average rock temperature gradient is 1 F per 108 ft, or 17 C per km.

Outdoor air for the lower mining area is pulled from the surface through a section of a large area of caved rock, formed by various mining operations including block caving, through the openings formerly used for mining, into the main airway 600 ft below surface. Resistance above the airway proper is only 0.35 in. water gage. Water is not impounded in the "intake" sections of the caved area, but drains down through the entire area and is handled by the main pumping system.

The air supplied to the lower production levels upcasts through the operating stoping blocks. The stopes are mined in horizontal slices 7 ft high. Each cut is timbered as the ore is removed, and, when a slice is completely mined, the previous slice is filled with waterborne mill tailings. The return air is drawn off at the top of the various mining areas into the main return; the lowest exhaust split is made 1200 ft below

surface, and the highest at a depth of 2600 ft.

The main return airway has solid rock walls which are smoother than the average mine opening. The airway is formed by driving a pilot raise and widening by long blast holes drilled on the perimeter of a circle around the pilot raise.

A trial was made using the warm saturated air from the lower levels directly to ventilate the upper mining area. The main objection is the fogging condition that results, seriously reducing visibility in the working areas. The return air is 68 F saturated at a point 2000 ft below surface, and cools to 61 F at surface, due mainly to expansion. Temperatures in the upper mining area vary from 35 to 45 F. Some economic means of appreciably reducing the moisture in the return air is required.

Jas. G. Rutherford
International Nickel Co. of Canada, Ltd.

Wants Information on Operating Costs, Maintenance Program at Iowa Hospital

The system design described by Robert W. Flanagan in his article *High Velocity Induction System Solves Hospital's Cooling Problems* (April) is basically sound, but there is no reference to design considerations relative to operating and maintenance costs. Such induction systems have proved expensive by virtue of preventive maintenance procedures and induction coil cleaning schedules. Based upon my experience, I have found that the units cannot operate longer than 30 days between cleanings.

It appears that the above-ceiling units are not advantageously placed when such frequent cleaning is necessary. This cleaning is not required because of the ventilation air, but is caused by the high degree of lint and other dirt brought in by visitors and the changing of hospital linen in the patients' rooms. Experience has shown that the coils on such induction units have to be removed and steam cleaned every 36 months.

The author does not state whether or not there are lint screens or filters on these induction units. This might be of interest. In either event, the manpower costs to properly maintain such a system so that the units will deliver designed air quantities are staggering.

It would be of further interest to know the location of the individual room thermostats in the patients' rooms. Are they by the bed where the patient has full control, or is it necessary to call a nurse each time a different setting is desired?

Other information of interest would be the coil face velocities, duct velocities, attenuation devices used, and static pressures in the systems.

What type of central chilled water plant and refrigeration was installed? What have operating costs been since this system was installed? The author goes to quite some length to economically justify such an installation. I would like to know what experience has proven in this justification of operations *vs* initial investment, including depreciation.

Daniel M. Roop
Hospital Consulting Engineer

The author's reply — I must disagree with Mr. Roop's statement that maintenance cost plus first cost is too high to warrant such a system. Since the primary air quantity is about the same as required for good ventilation, there is no penalty on the refrigeration load. The extra 10 hp of fan motor is the only penalty, plus a 7½ hp secondary chilled water pump.

A low velocity air system could not be used in the 1951 wing; therefore either an all chilled water fan-coil system or some form of a high velocity air or air-and-water system had to be. On this basis the aforementioned penalties disappear. The cost of the individual room units would not be a penalty as other systems would incur comparable costs. Actually, low velocity systems would have offsetting penalties of greater first cost in ductwork and general construction costs. To give the same quality of individual room control, there would be little difference in costs.

Any extra maintenance cost due to cleaning of lint screens is not a major item, compared with the savings in rentable floor area achieved. The lint screens are so designed that they can be vacuumed without removal. Only about once a year need they be removed and washed down. No extra maintenance personnel was hired due to the installation of this system.

A low velocity system would have necessitated allotting two rooms on each three floors for equipment space. At $30 per day per room, or $180 a day total lost due to such equipment space, it soon becomes evident why the maintenance costs are minor compared to the overall savings gained.

In the system design, the initial main header velocity is 2600 fpm, the vertical riser velocity is 2900 fpm, and the horizontal branch header velocity is 3600 fpm. The primary fan operates at approximately 7 in. water gage. A 16 ft long, 26 in. diameter sound absorber, using 2 in. of glass fiber lining, is used for the sound absorber section. The centrifugal refrigeration machine was selected for 42 F leaving chilled water and 52 F return water.

Robert W. Flanagan
Engineer
Daniel B. Stevenson, Jr.
Consulting Engineer

Disagrees on Temperature Ranges At Which Graphitization Occurs

I have read the article *Carbon Steel Has Its Problems, Too; When Piping Steam at 800 F*, by I. A. Rohrig (June), and think that, on the whole, his discussion contains some useful supplementary information of

interest to engineers concerned with graphitization in power piping systems.

However, I am not quite in agreement with his implied statement that graphitization in carbon molybdenum steels would not occur at temperatures below 900 F. Mr. Rohrig states "that it can occur in such (carbon steel) piping to a harmful degree at 800 F, or approximately 100 F lower than in carbon-moly steel." We have observed serious graphitization in carbon-molybdenum steels and main steam piping operating at temperatures at 810 F. I also do not agree with the statement that: "No failures have occurred in carbon steel piping." We have seen a number of failures in carbon steel piping as well as in carbon-molybdenum steel piping.

The reason that little is known about carbon steel pipe failures is that only about 5 percent of the power plant piping involved in graphitization is made of carbon steel. By far the great majority involves carbon-molybdenum steel.

Although Mr. Rohrig mentions only a few additional examples of service failures, such as stress corrosion cracking, we have actually seen about 20 other types of failures in power plant piping originally sampled for graphitization only. These failures include stress corrosion cracking, corrosion erosion, thermal fatigue, incorrect welding filler metals, insufficient flexibility in the piping system itself, surface notches and die marks on pipe inside diameters, laminar defects in the steel along the inside surface, improperly made welds, incorrectly welded-in backing rings, and many others.

HELMUT THIELSCH
Metallurgical Engineer
Grinnell Co., Inc.

THE AUTHOR'S REPLY — Mr. Thielsch's comments indicate that my article has had a satisfactory effect in bringing attention to carbon steel piping systems and pointing out that they are not aloof from the difficulties encountered in carbon-molybdenum piping.

In the introductory paragraphs of my article, the reader will note that I refer to failures at welded joints in carbon-molybdenum piping operating at 900 to 935 F in three different power plants. Next, I proceed to point out that serious graphitization also occurs in carbon steel piping at 800 F or approximately 100 F lower than in carbon-molybdenum steel. The facts are that published accounts of failures reported at welded joints in carbon-molybdenum piping have occurred in material operating in the temperature range of 900 F. It would be a misinterpretation for anyone to assume that carbon-molybdenum steel does not graphitize below 900 F, because we all agree that graphitization in carbon-molybdenum piping does not stop automatically when the temperature drops below 900 F. There is a great variation in susceptibility between individual pieces of pipe and heats of steel.

Mr. Thielsch's statement that he has seen serious graphitization in carbon-molybdenum steel operating at 810 F is an unusual finding and I'm sure he will agree that serious graphitization at 810 F in carbon-molybdenum steel is an exception. My first reaction is to ask for more information regarding the thermal history, service temperature history, and analysis of the material. For a number of years it has been common practice in the petroleum industry to use carbon-molybdenum steel at temperatures up to 950 and 1000 F, which is much higher than used in steam power piping applications. Yet, the petroleum industry had relatively little trouble with carbon-molybdenum steel due to graphitization. These differences are not readily explained; they only emphasize that we should be guided by experience.

I am quite interested in Mr. Thielsch's statement, "We have seen a number of failures in carbon steel piping as well as in carbon-molybdenum steel piping." Apparently, accounts of failures in carbon steel piping due to graphitization have not been published because the literature mentions only the failures in carbon-molybdenum steel.

My article pointed out that, owing to conditions of service, harmful phenomena such as graphitization, corrosion fatigue, and stress-corrosion cracking can occur in carbon steel piping at 800 F and that sampling is advisable to determine if the piping is either free of or affiliated with such difficulties. With regard to the materials used and the temperatures of use, each piping system should be judged individually, because, as the reader knows, experiences at different plants are not always alike.

I. A. ROHRIG
Materials Engineer, Generation Div.
General Engineering Dept.
The Detroit Edison Co.

Ionization Looms as Very Important Consideration in Air Conditioning

IONIZATION of air in enclosures is becoming an important consideration in air conditioning. Research, as presented by Karl E. Schaefer in his *Airborne Condensation Droplets, Ions May Be Important Health Factors* (May, June, and July), is very informative and should lead to extended applications as our knowledge of the subject expands.

An excess of negative ions results in improved health and comfort conditions. It is noted that, while artificial ionization, in order to produce an excess of negative over positive ions, exerted a normalizing influence on the human organism, it did not lead the investigators to believe that these effects were so highly significant as to warrant the use of artificial ionization for general ventilation. However, the use of negative ions in the treatment of hay fever and asthma appears to be presently feasible.

The relation between ionization and droplets is very interesting. The effect of inhaled droplet condensation appears to have toxic significance under certain conditions. Increased contamination of industrial and urban atmospheres will add to the importance of these findings.

Unfortunately, it was found that an increase in the CO_2 content of the atmosphere inversely affects the desirable negative ions. In closed spaces, such as submarines, block houses, and protective shelters against chemical, biological and radiological effects, this is important. The undesirable effect of an increase in the CO_2 content of the atmosphere on lung action has been previously presented in graphic form in the article, *How to Plan Air Conditioning for Protective Shelters* (December 1954, p. 87, Fig. 4).

It is also unfortunate that radium paint, gamma rays, and x-rays produce increased ionization—predominately positive. It would appear from the data presented, that the engineer in designing enclosures with restricted ventilation should carefully consider radiation effects, CO_2 content, and extent of positive ionization. He should utilize whatever means are at his disposal to maintain health and comfort conditions within practical limits in such enclosures.

WARREN VIESSMAN
Mechanical Engineering Consultant
Installations Headquarters
Air Research & Development Command
U. S. Air Force

Concurs with Author on Requisites for Supply Air System Freeze Protection

THE ARTICLE *How to Design Makeup Supply Air Systems for Freeze Protection*, by John H. Clarke (April), is timely and a welcome addition to the series Mr. Clarke has written for Heating, Piping & Air Conditioning during the last year or so.

Several of his points cannot be emphasized too strongly. These include provision of:

1) A constant steam pressure to the control valve, usually obtained by installing a suitable pressure regulating valve in the system.

2) A vacuum breaking arrangement to prevent an induced vacuum due to partial or complete closing of the control valve and the resultant holding of the condensate in the coil.

3) Means for rapidly eliminating both air and condensate when the valve again opens.

As Mr. Clarke points out, these are prime requisites in preventing freezing, but all are necessary on any steam coil if stable automatic control is to be obtained.

Regarding the vacuum breaker, I too would be interested in knowing how a bottom connection for this originated. But I would be more interested in seeing the proper connections indicated in the various coil manufacturers' catalogs and other literature.

For eliminating air I prefer a separate thermostatic trap, piped above the main trap, even where the main trap is equipped with a thermostatic air vent. This not only reduces sludge and sticking problems mentioned by Mr. Clarke, but provides more rapid air elimination because the air does not have to follow the water down through the drain piping and main trap.

The function of a modulating control valve is to reduce the pressure in the coil, and it does this by restricting the flow of steam. The equalizer prevents the reduction of the coil pressure below that in the return whenever the valve reduces the steam flow beyond a certain value. A lift in the return line requires a difference in pressure for it to operate. It is apparent that a throttling control valve and a return line lift are incompatible. Yet, it is astonishing how many times both will be applied to the same coil.

H. W. ALYEA
Director of Engineering
Johnson Service Co.

Flexible System Illustrates Modern Industry's Environmental Needs

THE REQUIREMENTS of modern industry demand environments of wide range. The article *Four Sets of Conditions Demand Unusual and Flexible System*, by Boris M. Lemos (June), is indeed illustrative of one such installation.

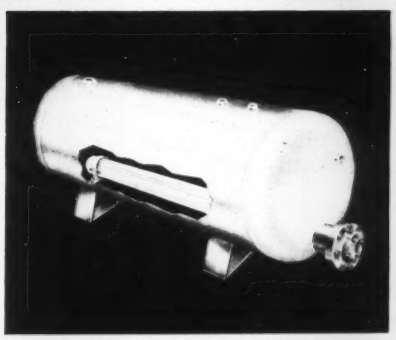
The need for guarding against contamination between zones of working spaces undoubtedly means the use of solid partitions and leakproof doors. In order to maintain "dustfree" areas, as Mr. Lemos describes his third "specific area," considerable turbulence must be provided. Stratification and pocketing are likely to develop in rooms of any size under normal supply and exhaust ventilation where tolerable velocities exist for ordinary working spaces.

I recall somewhat similar requirements for close temperature and humidity tolerances in a room 15 × 15 × 9 ft used for metabolism testing of caged rats. Here, the air conditions had to be uniform throughout the space as the cages were installed over most of the area. The room had two supply ducts furnishing tempered air at 400 fpm. A temperature variation of about 5 F existed until ventilating fans were installed in the room to create sufficient turbulence to maintain uniformity within $\frac{1}{2}$ F. The degree of turbulence necessary for maintaining such conditions throughout the entire room might be objectionable in many work areas. Perhaps Mr. Lemos' requirements for the "dustfree" area are for the supply only and do not apply for all sections of the work space.

The interchangeability provided by ductwork for air conditioning in each of the building columns, the adaptability of individual fan housings, and the availability of the utility services on 20 ft centers make this installation truly flexible.

LESTER S. RIES
Consulting Engineer

Columbia Hospital, Milwaukee, Wisc. – Bakersfield Memorial Hospital, Bakersfield, Calif. – Rhode Island Hospital, Providence, R. I. – D. C. Hospital Center, Washington, D.



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question of the month

"Will Anti-Freeze Harm Boilers, Greatly Affect Heat Transfer?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with an answer that has been received from a reader. Other answers appeared in the July issue. Further comments for publication are invited.

"We are installing packaged hot water heating boilers in five buildings remote from the boiler rooms. The buildings are to be heated with a hot water heating system filled with 42 percent ethylene glycol solution. We are using an anti-freeze with the following analysis:

Ethylene glycol, percent by weight, min.	*90.3*
Diethylene glycol, percent by weight, min.	*5.0*
Total gycols, percent by weight, min.	*95.3*
Borax (decahydrate), percent by weight	———
Borax (pentahydrate), percent by weight	*1.9*
Water, percent by weight, max.	*2.3*
Dye, grams per gal	*0.3*
pH, 30 percent solution	———
pH, 50 percent solution	*7 to 8*
Reserve alkalinity	*14.2 to 15*
Freezing point, F	
50 percent solution	*34*
30 percent solution	———
Specific gravity, 77 deg at 60 F	———
Specific gravity, 25 deg at 25 C	*1.118 to 1.122*

"The boiler manufacturer has withdrawn the warranty on the boilers because the system is using this solution instead of water.

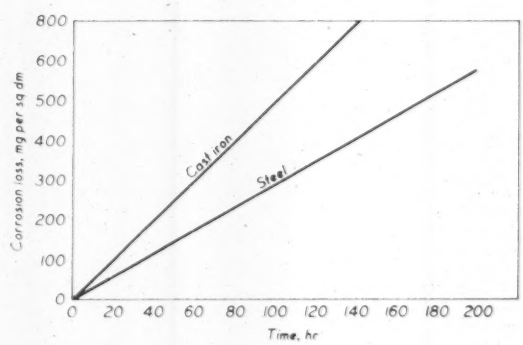
"We would like to know if any other readers have any experience using an anti-freeze in boilers and, if so, if it will harm the boilers or materially affect the heat transfer."
—R.T.F.

Ethylene Glycol Solutions Usually Have Inhibitors Which Resist Corrosion

ETHYLENE GLYCOL is an olefinic series hydrocarbon having the chemical formula C_2H_4. Approximate boiling points for different solution strengths are as follows:

Solution, percent	Boiling point, F
30	220
42	224
50	226
60	230
70	238
90	300
100	330

R.T.F. has not indicated the operating temperature of the heating system. For a 42 percent solution, 224



1 CORROSION LOSS for cast iron and steel with 40 percent solution at 160 F and pH of 7 increases with time at these rates

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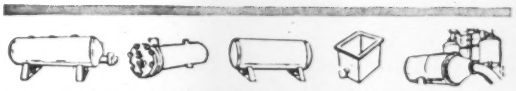

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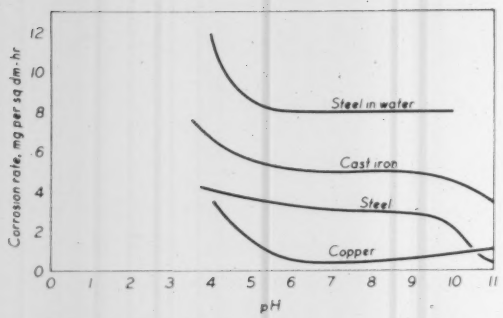
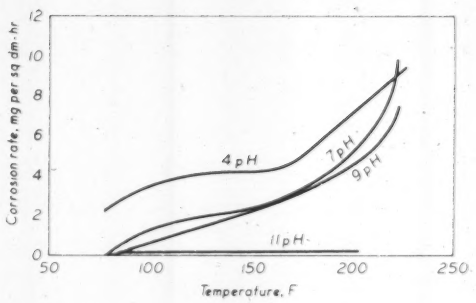


2 CORROSION RATES shown here for various metals in 40 percent solution at 160 F with different pH values



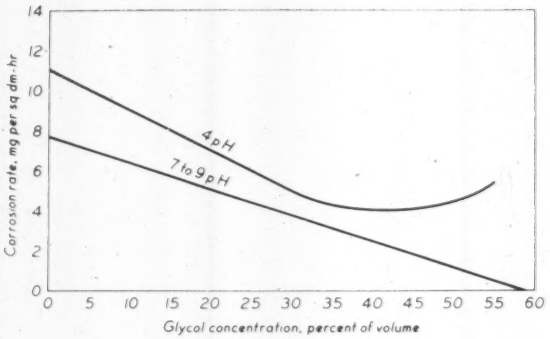
3 OVER RANGE of different temperatures, steel in a 40 percent solution will corrode at the rates shown for four different pH values

F may be used without boiling occurring. Vapors from glycol water solutions contain very little glycol, the values being about 1 to 2 percent.

Usually, ethylene glycol solutions contain inhibitors which increase stability and provide alkaline reserve. The latter offers a protective film against corrosion of metal parts such as boiler tubes and tube sheets, pipes, valves, and fittings.

Hot water heating installations containing ethylene glycol solutions have been used successfully for snow melting operations and other heat transfer applications. Included in the latter are internal combustion engine jacket cooling systems which are subjected to high operating temperatures.

H. B. Wayne
Consulting Engineer



4 AT 160 F, steel will corrode at these rates for different solution strengths, various pH values

READER ASKS—

"Will Redesigned Steam Header Using Same Welding Cap Be Safe?"

"I am in the process of redesigning a 12 in., extra heavy, ASTM-A 106 Grade B steam header for steam at a pressure of 450 psi and at a temperature of 750 F. The header is to be lengthened.

"I plan to cut the present header at the cap weld, attach the required additional length of pipe, and use the same welding cap to close the new length.

"The header has been in service for about three years, intermittently. The temperature in the header has reached 800 F as the maximum during some of the cycles of operation.

"I would like to know if it is safe to use the end cap in this redesigned steam header. Also, what special precautions should be taken in the fabrication of this new header if it is safe? Would it be acceptable to weld the new length of pipe to the header where the former welding joint has been?"—J.G.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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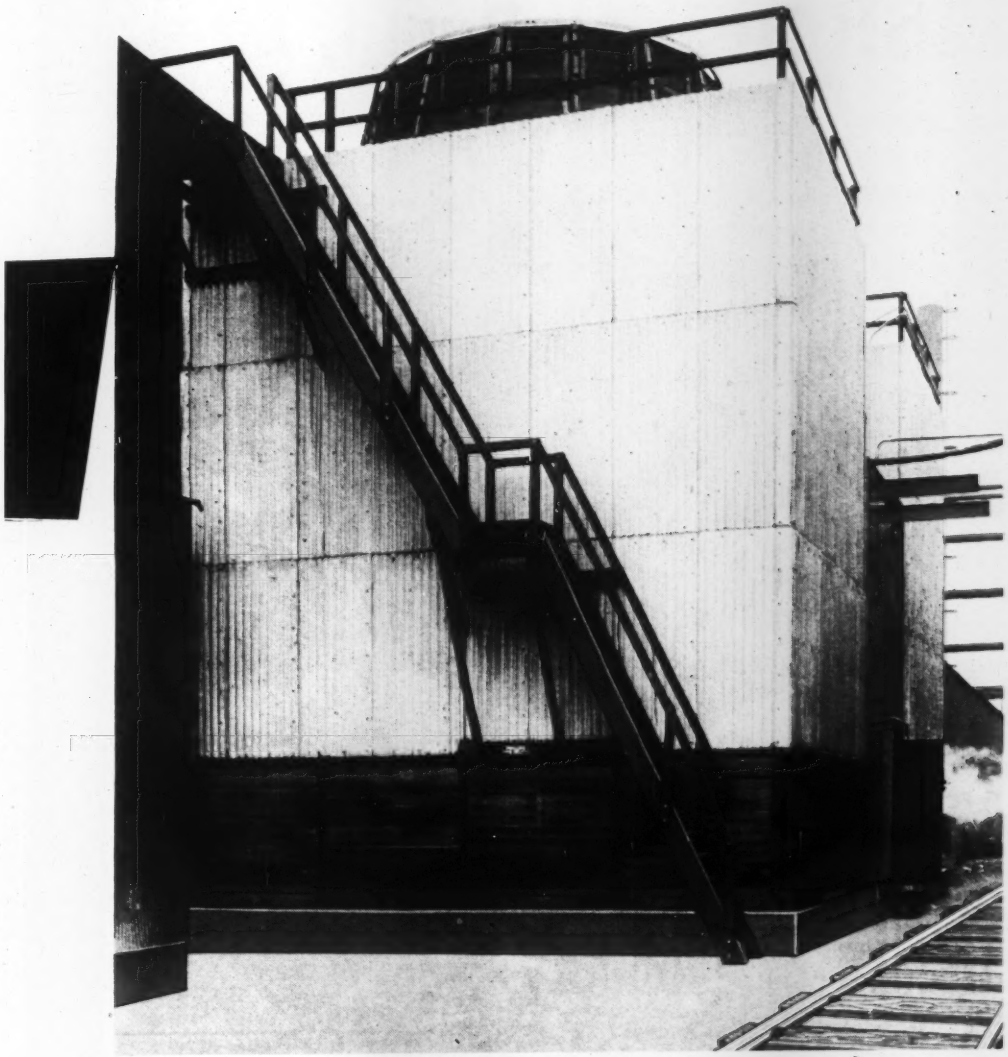

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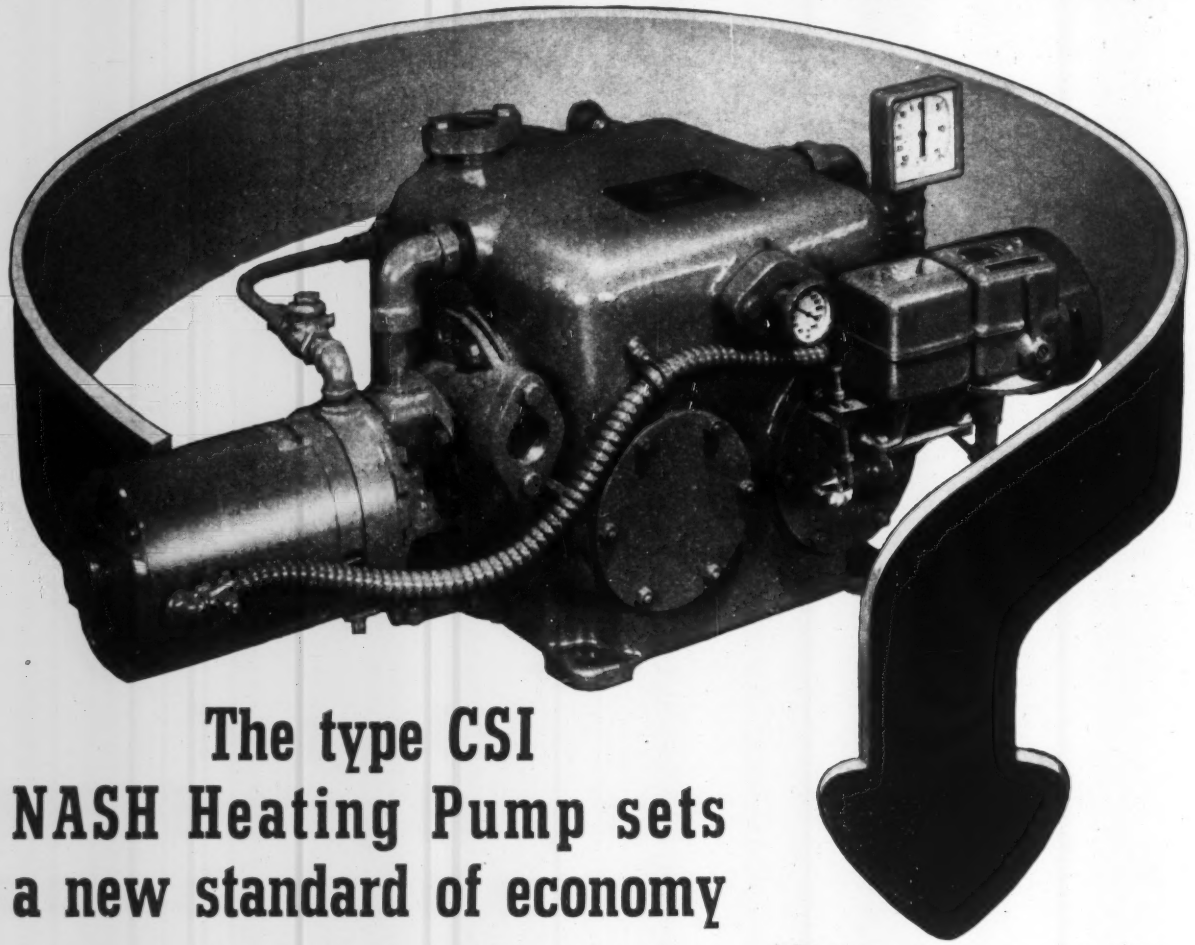

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3 **ECONOMY OF OPERATION**

4 **ECONOMY OF MAINTENANCE**

NASH ENGINEERING COMPANY
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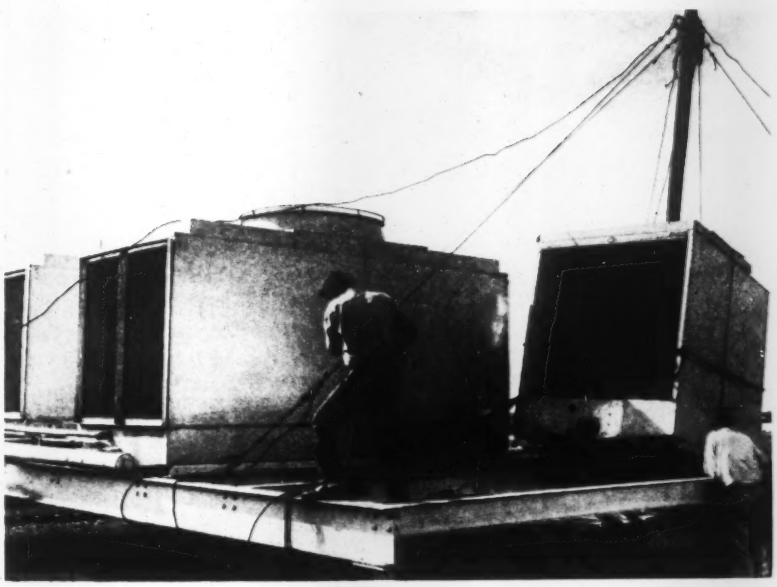
COOLING TOWERS were hoisted to rooftop as part of three-stage installation program. Three 100 ton units were selected rather than one large one because of initial cost savings and because only two 100 ton towers would be required initially. Base was made large enough for third tower to be added later

Packaged Units Cool 33-Year-Old, 11-Story Office Building



Installation of biggest packaged job completed in three construction stages

BY R. G. HURSTAD
Chief Engineer
Air Conditioning Div.
Sidles Co.

WHEN IT WAS decided to completely air condition the 33-year-old, 11-story Livestock Exchange Bldg. in Omaha, several different methods were explored. The building owner, the Union Stockyards Co. of Omaha, Ltd., asked that a unified plan for complete air conditioning be developed in 1957.

This plan called for three stages of construction, one-third to be finished by early 1958 for testing purposes. The second third was to be completed by the summer of 1958 if the first stage test were successful, and the final third was to be started during the fall and winter of 1958.

In the preliminary planning sessions the following major requirements were stated by C. B. Dull,

Requirements set forth before project was started

chief engineer of the Union Stockyards Co.:

1) Equipment should occupy no usable floor space in rental areas.

2) The system should be relatively simple to install.

3) Operation and maintenance should not require specialized personnel.

4) Since the structure had some 67 tons of cooling capacity already in service in certain areas, existing equipment should be utilized wherever possible and practical.

5) Cost estimates should cover several types of systems.

● Cost estimates of three proposed air conditioning systems — the first using large packaged units, the second using chilled water with zone air handling units, and the third using chilled water with individual room units — led to the decision to use packaged units to completely air condition Omaha's Livestock Exchange Bldg. The building owner required that the installation be made in three stages, and that the equipment take up no rentable floor space. How this system was able to meet these and other requirements is told here.

The author received his BS in chemical engineering in 1950. He joined Sidles Co. in June of that year and was associated with that company until this past January. As of February 1, he is one of the principals in the newly formed mechanical contracting organization, Climate Control, Inc. He is a registered professional engineer in the State of Nebraska.

Compare Costs of 3 Systems

Three system designs were proposed for air conditioning floors one through nine of the building. The estimates are based on 274 tons of cooling capacity required for these floors. Design conditions used in arriving at this total capacity are as follows:

Outdoor air:	95 F DB; 78 F WB
Indoor air:	75 F DB; 64 F WB
Ventilation air:	2000 cfm per floor
People load:	100 personnel per floor
Light load:	18,000 watts per floor

● System No. 1:

Based on the use of large packaged units, the first proposed system was to consist of:

1) Nine 30 ton packaged units, one on each floor in the vacant elevator shaft. Ductwork was to be extended along hallway ceilings to supply outlets in rooms as required. A free return air system was to be provided, with three door grilles into hallways for return to the equipment room. Controls were to include one thermostat for each floor, with two-stage operation of the unit.

2) One cooling tower on a steel base on the penthouse roof.

3) Two pumps in the penthouse.

4) Cooling tower piping installed in the elevator shaft.

5) Electrical wiring service increased by running a new bus duct (plug-in type) to the ninth floor. Conduit was to be extended up to the penthouse and wiring connections made to all equipment, including controls and interlocks.

The cost for this system (not including furring down hall ceilings, installing floors in the elevator shaft, and redecorating) was estimated at $150,000.

Two alternate possibilities to this system were studied:

System No. 1A was the same as System No. 1 except that it called for two 15 ton packaged units per floor, providing two-zone control on each floor. Its estimated cost was $160,000.

System No. 1B went a step further and proposed the use of four 8 ton packaged units per floor, thus providing four-zone control on each floor. The estimated cost of this system was $170,000.

● System No. 2:

The second system specified the use of chilled water, with four zone air handling units on each floor. This arrangement was to consist of:

1) Nine multi-zone air handling units located in the unused elevator shaft. One unit was to serve each floor. Ductwork was to extend from the unit down hall ceilings to supply registers as required. The supply duct was to be split to provide four separate zones. A free return air system was to be installed, similar to System No. 1. Controls were to include four thermostats on each floor for zone control.

2) Three packaged water chillers, located in the penthouse where old water tanks were located.

3) One cooling tower on a steel base on the penthouse roof.

4) Four pumps in the penthouse.

5) Cooling tower piping and chilled water lines to be installed in the unused elevator shaft. Chilled water lines were to be insulated.

6) Electrical wiring service was to be increased by running a new bus duct to the penthouse for wiring connections to all equipment. Controls and interlocks were to be included.

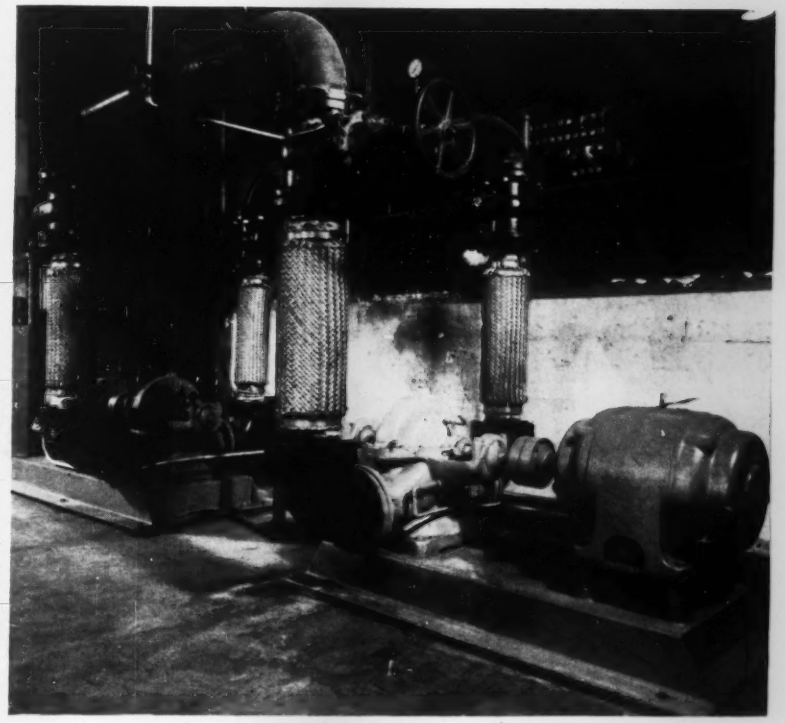
The estimated cost for this type of system (again not including furring down hall ceilings, installing floors in the elevator shaft, and redecorating) was $199,000.

● System No. 3:

This system proposed the use of chilled water with individual room units. This installation was to consist of:

1) A total of 250 individual room

were met through careful planning and design



TWIN 25 hp pumps are located in penthouse beneath cooling towers. One is for normal use, other for emergency

units located in hallway ceilings with duct connections to rooms. Outdoor ventilation air was to be supplied through furred down hall ceilings serving as ducts.

Controls were to include room thermostats for each room unit to provide individual control.

2) Four large air handling units to serve areas not adaptable to the individual units.

3) Three packaged water chillers located in the penthouse.

4) One cooling tower on a steel base on the penthouse roof.

5) Four pumps located in the penthouse.

6) Cooling tower piping and chilled water lines to be installed in the unused elevator shaft. Chilled water branch lines were to be concealed in furred ceilings. All chilled water piping was to be insulated.

7) Electrical wiring service was to be increased by a running new bus duct to the penthouse for wiring connections to all equipment. Controls and interlocks were to be included.

The cost for this type of system (not including furring down hall ceilings and redecorating) was estimated at $225,000.

Choose System No. 1A

After weighing these estimates carefully, it was decided to proceed with final plans for System 1A. System 1B was actually preferred because of its provision for better control, but it was eliminated because of space limitations in the elevator shaft.

Only five of the 15 ton units were included in the first phase of installation, but the cooling tower piping and the electrical system were installed complete with provisions for the addition of more units at a later date.

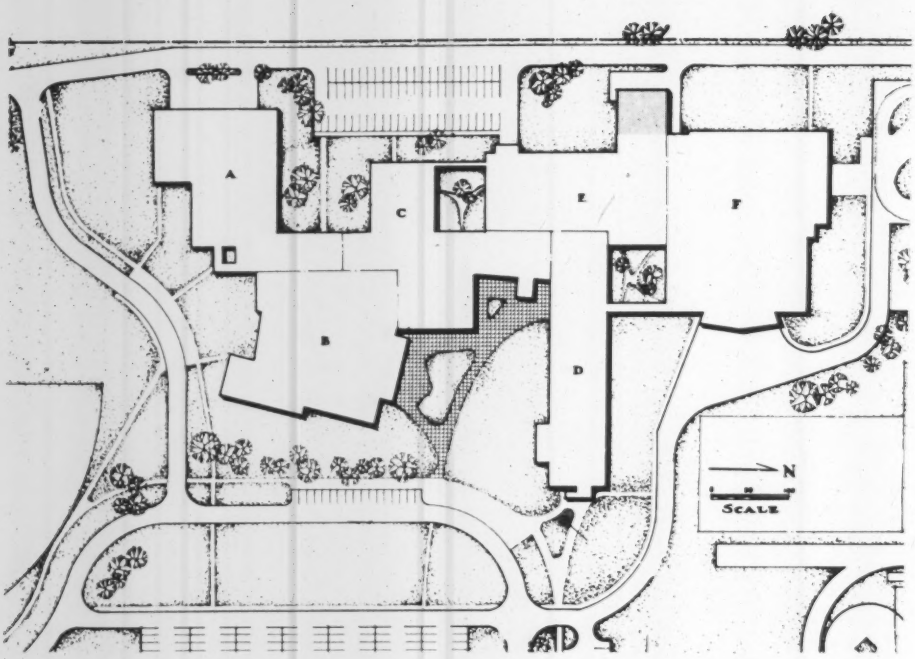
The cooling tower piping system was to be connected to the existing units that had been installed previously.

Three 100 ton cooling towers were planned rather than one large one because of savings in initial cost and because only two 100 ton towers would be required at that time. The base was made large enough for the third tower to be added later.

Tests Prove Satisfactory

The first phase of the installation was completed in the spring of 1958 and the system operated very satisfactorily. As a result of this test installation, three more 15 ton units were installed during the summer before the cooling season ended. During the winter, five more units were installed, as was the third cooling tower.

This building consists of 254,000 sq ft of space and is considered to be one of the largest buildings to be completely air conditioned by packaged units. With the units located in a vacant 7 ft square elevator shaft, no rental space is used. Thus, this requirement, set forth before the project was started, was met — as were the others — through careful planning and design. ‡



1 PLOT PLAN of Everett High School, illustrating building size and boiler room location (shaded area at top of Unit E), reveals immediately why this wasn't an ordinary school heating job

How HTHW Meets Heating Needs of This New School

BY ANTON KRAPEK
Vice President
E. Roger Hewitt Associates, Inc.
Professional Engineers

• The consulting engineers decided on HTHW as the best way to solve the problems imposed by this new school's large size and boiler room location. Several heating methods are used in various parts of the building—including unit heaters, unit ventilators, convectors, and built-up heating and ventilating units—all supplied by HTHW.

Mr. Krapek, born in Czechoslovakia, is a naturalized U. S. citizen and a graduate of Alma (Mich.) College & Aeronautical University. He is a registered professional engineer in Michigan and Indiana and a member of several engineering societies and associations.

IN DETERMINING the type of heating system for the new Everett High School in Lansing, Mich., the consulting engineers first considered space heating and distribution methods normally employed in smaller school buildings. However, building size and boiler room location played a large part in influencing final selection.

First thoughts for primary distribution considered the use of low pressure steam. Exploration of this idea revealed that tunnels would have to be made deeper than desirable, due to dripping and condensate removal. Also, multiple condensate pumping stations would be required. A 16 in. steam main and an 8 in. condensate return leaving the boiler room would also be needed.

Thinking then turned to the use of high-pressure steam. This method would permit the use of smaller pipe sizes (8 in. steam and 6 in. return), but other problems would remain unanswered and would add the possible steam flashing problem.

Low temperature hot water was considered next, and seemed to meet basic requirements. Tunnel depths

could remain as originally designed and condensate pumping stations could be eliminated. But again, negative factors began to reveal themselves. Main sizes would still be rather large (10 in. supply and return) and pump capacities would be high. Also, temperature drop through the extremely long mains might be too great.

Decide HTHW Meets Conditions

After these methods were decided against, the possible use of high temperature hot water was considered. It was found that the solutions to the aforementioned problems fell naturally into place. Main sizes became relatively small (6 in. supply and return), pump capacities were greatly reduced, temperature drop problems were virtually eliminated, and dead level runs were possible.

The final selection therefore was a high temperature hot water system operating at 100 psig with a supply temperature of 320 F and a return of 220 F.

Three Gas Fired Boilers

HTHW is supplied by three modified gas fired water tube boilers rated at 12.5 million Btu per hr. The piping system is nitrogen charged to maintain the necessary pressures in the system and is pressure fed through a vertical expansion tank. Each boiler has its own water cooled circulating pump and, through header piping, joins one main leaving the boiler room.

Trace Mains Through School

After leaving the boiler room (located at the northwest end of Unit E in Fig. 1), the supply and return mains traverse walk-through tunnels along the north end of Unit E to the northeast corner, then turn and extend south through Units D, C, and B, and terminate at Unit A. As the mains travel their routes, various runouts are encountered in each of the building units. These serve hot water heaters, pool heaters, and space heating convertors.

Each convertor is complete with its own hot water specialty assembly, water feed, and high temperature supply three-way mixing valve. Convertors serving all units except Unit D have been selected to perform with 320 to 220 F supply, and to deliver the required water flow at a 220 to 180 F space heating temperature. Each building unit has its own pumping and distribution system.

Use Various Types of Heating

Various types of heating are employed in the building. For example: In Unit A, shops are heated by unit heaters, drafting rooms by unit ventilators, cribs by convectors, and entry ways by forced flow convectors; in Unit B, the auditorium is heated by a built-up heating and ventilating unit; the dramatics, multi-purpose, band and vocal rooms by similar manufactured units, art rooms by unit ventilators, and other areas by finned tube and convectors. In Unit C, laboratories are heated by ceiling hung unit ventilators, with finned tubing behind cabinets under windows, and other areas are being heated by miscellaneous radiation; in Unit E, the cafeteria and activities rooms are heated by ducted unit heaters, and the kitchen by a heating and ventilating unit and miscellaneous radiation. In Unit F, the natatorium and gymnasium are heated by heating and ventilating units, locker rooms by ceiling hung unit ventilators, and other areas by miscellaneous radiation.

Unit D, the four-story main classroom wing, has a 220 F convertor serving finned tube radiation in the storage areas, greenhouse, and connecting corridor between Units D and F. In addition, another convertor, this one with a 160 F supply temperature, serves the balance of Unit D and the administrative section in Unit C.

Provide Summer Cooling, Too

This convertor, with its pumps, is interconnected with a hermetically sealed centrifugal water chiller. Piping is arranged to permit bypassing of either chiller or convertor as dictated by seasonal requirements. Chilled or heated water is pumped to unit conditioners. Classroom units are equipped with outdoor air intakes, while units in smaller areas are for recirculation only.

Due to the nature of the laboratory table layouts, lab rooms had to be given special consideration. In these areas, ceiling hung heating, ventilating, and cooling units, ducted to outdoor air intake louvers and ceiling diffusers, are being installed.

The administrative section, remotely located in Unit C, will have its own pumps for circulating water to recirculated air conditioning units. Condenser water is supplied from two self-contained induced draft cooling towers in a louvered penthouse at the southwest corner of Unit D.

Provide Pump Standbys

All water circulating pumps, except high temperature, are duplicated on a standby basis to permit maintenance without fear of shutdown of any of the systems. Boilers were selected to permit two-unit operation, with the third unit acting as standby. Wherever possible, piping is designed on the reverse return principle.

Temperature controls throughout the building are primarily pneumatic. The HTHW piping is extra heavy black steel and low temperature piping is standard weight black steel, as is the cooling tower piping.

Other features of the mechanical system include forced and gravity ventilation, a vacuum cleaning system, carbon monoxide exhaust for the automotive repair shop, a reclaimed air dust collection system, gas distribution to laboratories, a spray booth with forced exhaust, acoustically dampered ductwork in low decibel areas, and a vacuum type diatomite pool filter.

Architects for the project are O. J. Munson Associates; the heating and ventilating systems were designed by E. Roger Hewitt Associates, Inc.; and the mechanical (heating, piping, and air conditioning) contractor is the R. L. Spitzley Heating Co. ∓

Many Ways to Use Heat Pump Cycle

Speaking before the 70th annual convention of the Mechanical Contractors Association of America in Washington, D.C., recently, E. R. Ambrose, head of the air conditioning division of American Electric Power Service Corp., New York City, pointed up the growing acceptance of the heat pump for year 'round air conditioning of commercial and industrial buildings. In his discussion Mr. Ambrose described various heat pump operating cycles and weighed the merits and possibilities of this type of system, citing installation and operating cost figures from existing installations to support his opinions. Heating, Piping & Air Conditioning presents a transcript of his talk on these pages.

MANY consulting engineers, contractors, and architects have come to realize that the heat pump is well suited for heating and cooling and meeting the other year 'round air conditioning comfort needs of many commercial and industrial structures.

Before evaluating the merits and possibilities of this type of system, it may be well to define what a heat pump is and briefly review some of its more popular operating cycles. The heat pump is a combination of refrigerating equipment designed and arranged so as to inject heat to a space during one period and to remove heat from the space during the other.

The basic heat pump cycle is identical with the conventional refrigeration cycle, except the primary objective is different. The heat pump uses both the rejected condenser heat and the cooling effect, while the conventional refrigeration system's main interest is only the cooling effect.

How the evaporator or cooling surface and the condenser are effectively used to supply cooling and heating is shown by Fig. 1. This schematically illustrates a heat pump flow diagram employing well water as the heat source and heat sink. It should be noted in this arrangement that the condenser, compressor, and cooler, together with the necessary refrigerant piping, can be shipped from the factory as a self-contained package with a hermetically sealed refrigerant circuit. The necessary water piping and valves and other accessories shown are added in the field by the contractor to complete the heating and cooling system.

The cooling cycle is depicted by the broken lines. In this cycle, the cold water is circulated in a closed loop consisting of pump "A," the cooler (where the temperature is reduced to 45 F), and the zone conditioners. At the same time, well water is circulated through another path consisting of pump "B," the condenser (where the heat is rejected from the system), and then through valve "B" to the sewer or return well.

The heating cycle in Fig. 1 is shown by the solid lines. Heating is provided by closing valve "B" and opening valve "A." In this way the well water flows through the cooler (where heat is removed) to valve "A," then to the sewer or return well, and pump "B" circulates the warm water in a closed loop through the condenser (where the water is heated to 100 or 110 F) and the zone conditioners.

Actually, this system is usually operated so that simultaneous heating and cooling is available at all times. This can be done quite easily without unnecessary complications and is one of the main advantages of this so-called indirect system.

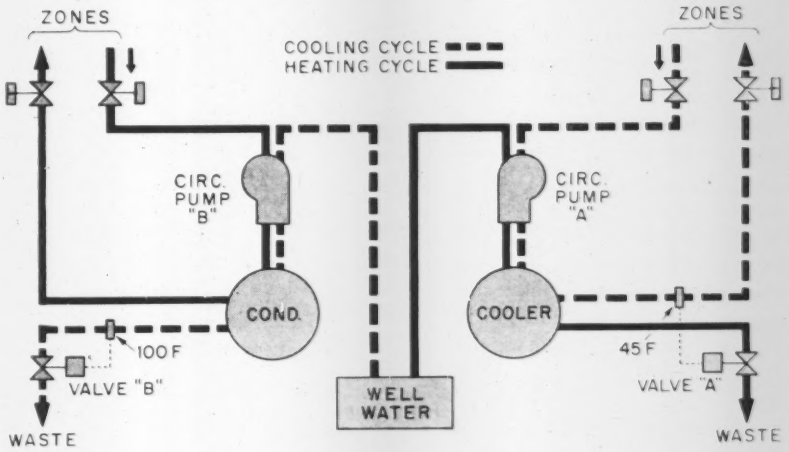
By substituting an air-to-liquid heat exchanger for the supply well, a system employing outdoor air as the heat source and heat sink will result, as illustrated by Fig. 2. The operation of this system is identical to that for the well water. It should be noted that, in areas where below freezing outdoor temperatures are experienced, an anti-freeze solution, such as methyl alcohol, must be used in the cooler circuit.

Change Direction of Flow

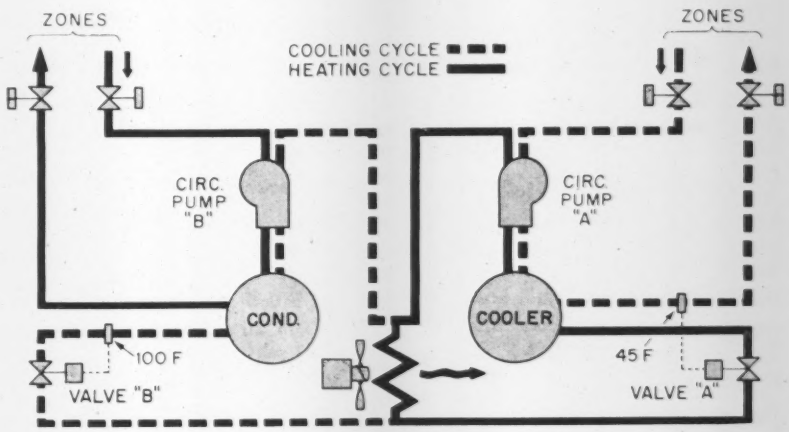
The two basic cycles described so far are usually classified as water-to-water and air-to-liquid systems with fixed refrigerant circuits. Another basic cycle in common use changes the direction of the refrigerant flow to obtain the heating and cooling effect. This cycle can employ either air or water as the heat source and sink, and air or water as the heating cooling medium going to the conditioned space.

In this cycle, provisions can also be made for simultaneous heating and cooling, as illustrated by Fig. 3. The more conventional heating and cooling cycle can be provided by

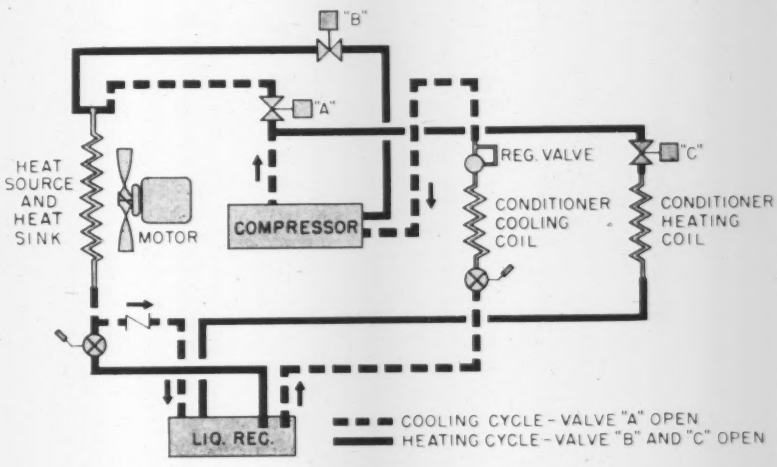
3 basic heat pump cycles



1 THIS HEAT PUMP CYCLE uses well water as heat source and sink to furnish simultaneous heating, cooling



2 BY SUBSTITUTING air-to-liquid heat exchanger for supply well, system employing outdoor air as heat source and sink will result



3 ANOTHER BASIC CYCLE changes direction of refrigerant flow to effect heating, cooling. Cycle can use either air or water as source and sink

substituting one four-way valve for the two two-way valves and by eliminating one of the two conditioner coils.

The heat pump cycles illustrated by Figs. 1, 2, and 3 are just a few of the many possibilities which are available for furnishing year 'round air conditioning. It is also interesting to note that all of the various types of distribution systems which are generally used with year 'round air conditioning can be used with heat pumps. These include hot and cold water indirect systems, high or low velocity duct systems, individual fan type or induction units which are generally located along exterior walls, or a combination of any or all of these systems.

At the present time, heat pumps, employing the change-in-direction-of-refrigerant-flow principle, are very popular. In fact, practically all of the smaller, so-called self-contained packaged equipment, of say 50 hp and smaller, as well as many of the larger systems up to 400 hp and over, make use of this cycle to obtain the heating and cooling effect.

The main advantage of this heat pump design is the possible lower first cost due to the elimination of one or two of the liquid-to-liquid heat exchangers. In larger systems this can be a material saving.

Many Factors Govern Selection

Whether these advantages are sufficient to effect a saving in the overall cost of the complete installation, however, will depend on a number of design and application factors—the architectural aspects of the structure, the geographic location, and the ventilation air quantities employed. The need for simultaneous heating and cooling, and for reheat to maintain the proper relative humidities, are also influencing factors in the final selection of the particular system to be used.

Heat Pump Loads May Vary

The trend in modern building is to employ double glazed windows and better insulation, and to use more and more internal areas with higher internal heat gain from lights, people, tabulating machines, and other similar heat dissipating equipment. Therefore the size, shape, and exposure of a structure, as well as the relative amounts of external and internal areas, are important factors in the design, equipment selection, and performance of any system.

Normally, the air conditioning system may be called upon during mild weather (40 to 50 F) to simultaneously furnish heating to the exterior zones and cooling to the interior. Also, the system may have to change daily or even hourly between the heating and cooling cycles, and to frequently use reheat in order to maintain the required indoor conditions.

It is apparent from the basic cycles just described and from the observation of a number of installations that the heat pump is not only exceptionally qualified for such application but frequently shows considerable savings in both first cost and operating cost over other types of systems.

How much these savings will be is usually difficult to predict in advance, because of the many design and application variables previously mentioned. It is therefore advisable, whenever possible, to check the estimated costs of the proposed system with the costs of an actual installation in the same general area. Considerable data, including the monthly kilowatts and kilowatt-hours for heating and cooling, is now becoming available on many different types and sizes of electric heat pump systems.

TABLE 1 — ANNUAL OPERATING COSTS for a heat pump year 'round air conditioning system using air as heat source and sink in Roanoke, Va., given here are based on actual field measurements

Total floor area, 1000 sq ft	85
Heat loss (70 F temperature difference)	
Occupied, 1000 Btu per hr	5550
Unoccupied, 1000 Btu per hr	2590
Heat gain, 1000 Btu per hr	313
Lighting, connected, kw	400
Annual electric energy consumption	
Cooling*, 1000 kwhr	338
Heating*, 1000 kwhr	217
Lighting and miscellaneous, 1000 kwhr	1890
Total, 1000 kwhr	2445
Operating cost	
Air conditioning cost*	
Electricity	$8,010.00
Lighting and Miscellaneous	27,442.75
Total	$35,452.75

*Excludes circulating pumps and conditioner and exhaust fans. These items are included under lighting and miscellaneous. Energy consumption and cost for domestic water heating, however, have not been included in any of the above figures.

Operating Costs Low

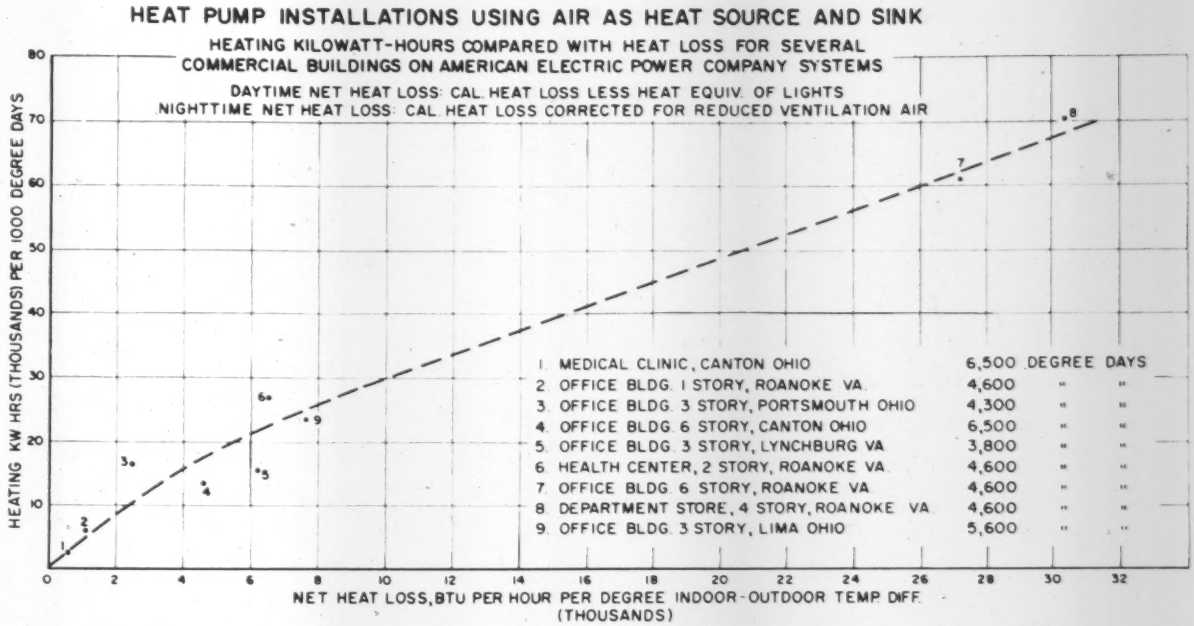
Just recently, a tabulation was made of the annual operating costs for a commercial building in Roanoke, Va. It has a heat pump using air as the heat source and sink, an 85,000 sq ft floor area, 313,000 Btu per hr heat gain, and 400 kw of lighting.

The annual operating cost of the air conditioning system was $8010.

Costs for water source heat pumps were given in the article, *Don't Over-*

TABLE 2 — DESIGN AND OPERATING DATA of typical heat pump installations in several areas are listed below. See Fig. 4

	Floor area, sq ft	Net heat loss per F indoor-outdoor temperature difference, 1000 Btu per hr	Power consumption, 1000 kw hr			Heating, kwhr per 1000 deg days	Degree days
			Heating	Cooling	Total		
Medical clinic (two-story) Canton, O.	1515	0.6	14.4	5.8	20.2	2.4	6500
Office building (one-story) Roanoke, Va.	2000	1.1	23.0	9.5	32.5	6.1	3850
Office building (three-stories) Portsmouth, O.	18,720	2.5	93.4	160.6	254.0	21.6	4328
Office building (six-stories) Canton, O.	35,000	4.6	87.3	184.5	271.8	13.5	6491
Office building (three-stories) Lynchburg, Va.	20,780	6.2	58.6	125.4	184.0	15.3	3827
Health center (two-stories) Roanoke, Va.	17,600	6.5	99.9	60.2	160.1	26.9	5722
Office building (six-stories) Roanoke, Va.	96,750	27.2	264.9	499.0	765.9	60.5	5809
Department store (four-stories) Roanoke, Va.	98,000	30.5	217.0	338.0	555.0	70.1	5809
Office building (three-stories) Lima, O.	24,000	6.8	127.5	64.2	191.5	25.8	5575


HEAT PUMP INSTALLATIONS USING AIR AS HEAT SOURCE AND SINK
HEATING KILOWATT-HOURS COMPARED WITH HEAT LOSS FOR SEVERAL COMMERCIAL BUILDINGS ON AMERICAN ELECTRIC POWER COMPANY SYSTEMS
DAYTIME NET HEAT LOSS: CAL. HEAT LOSS LESS HEAT EQUIV. OF LIGHTS
NIGHTTIME NET HEAT LOSS: CAL. HEAT LOSS CORRECTED FOR REDUCED VENTILATION AIR
HEATING KW HRS (THOUSANDS) PER 1000 DEGREE DAYS
NET HEAT LOSS, BTU PER HOUR PER DEGREE INDOOR-OUTDOOR TEMP. DIFF. (THOUSANDS)
1. MEDICAL CLINIC, CANTON OHIO 6,500 DEGREE DAYS
2. OFFICE BLDG. 1 STORY, ROANOKE VA. 4,600 " "
3. OFFICE BLDG. 3 STORY, PORTSMOUTH OHIO 4,300 " "
4. OFFICE BLDG. 6 STORY, CANTON OHIO 6,500 " "
5. OFFICE BLDG. 3 STORY, LYNCHBURG VA 3,800 " "
6. HEALTH CENTER, 2 STORY, ROANOKE VA. 4,600 " "
7. OFFICE BLDG. 6 STORY, ROANOKE VA 4,600 " "
8. DEPARTMENT STORE, 4 STORY, ROANOKE VA 4,600 " "
9. OFFICE BLDG. 3 STORY, LIMA OHIO 5,600 " "

4 RELATIONSHIP seems to exist between heat loss per indoor-outdoor temperature difference and heating kilowatt-hours per 1000 deg days. This is possible basis for predicting power consumption for heat pump installations

look the Heat Pump (Heating, Piping & Air Conditioning, March 1959, pp. 126-128) for several installations in Portland, Ore. A 5-40 hp well water installation had an annual heating cost of 2.2 cents per sq ft and a cooling cost of 9.1 cents per sq ft—a total of 11.3 cents per sq ft. In comparison, the national average of all air conditioned buildings in the country was given in the article as 7.74 cents per sq ft for heating, 16.9 cents per sq ft for cooling, for a total of 24.6 cents per sq ft. Also, the total operating cost of this Oregon installation, including labor and maintenance charges but excluding annual depreciation charges, was 11.3 cents per sq ft of rentable area as against 27.3 cents for the national average.

The fact that the annual operating cost for this particular building (with a large internal area) is less than half of the national average is interesting and encouraging, but is not necessarily conclusive proof that a heat pump will always have such an advantage over other types of air conditioning systems. Relative cost of electric energy and fuels, as well as the geographic location, are influencing factors in any such comparison.

Various tabulations of performance data have been made for a number of different sizes and types of heat pump systems. These tabulations include monthly and yearly kilowatts and kilowatt-hours for heating, lighting, and other internal heat gain, as well as the calculated heat loss and heat gain along with other data.

A Possible Comparison Basis

It is rather difficult to find a basis on which to evaluate and compare such systems because of many influencing variables. But some relationship seems to exist between the net heat loss per indoor-outdoor temperature difference and the heating kilowatt-hours per 1000 degree days, as is shown in Fig. 4 and Table 2. The net heat loss is the calculated gross heat loss, less the heat equivalent of the lights and other internal heat gain which can be considered useful heat.

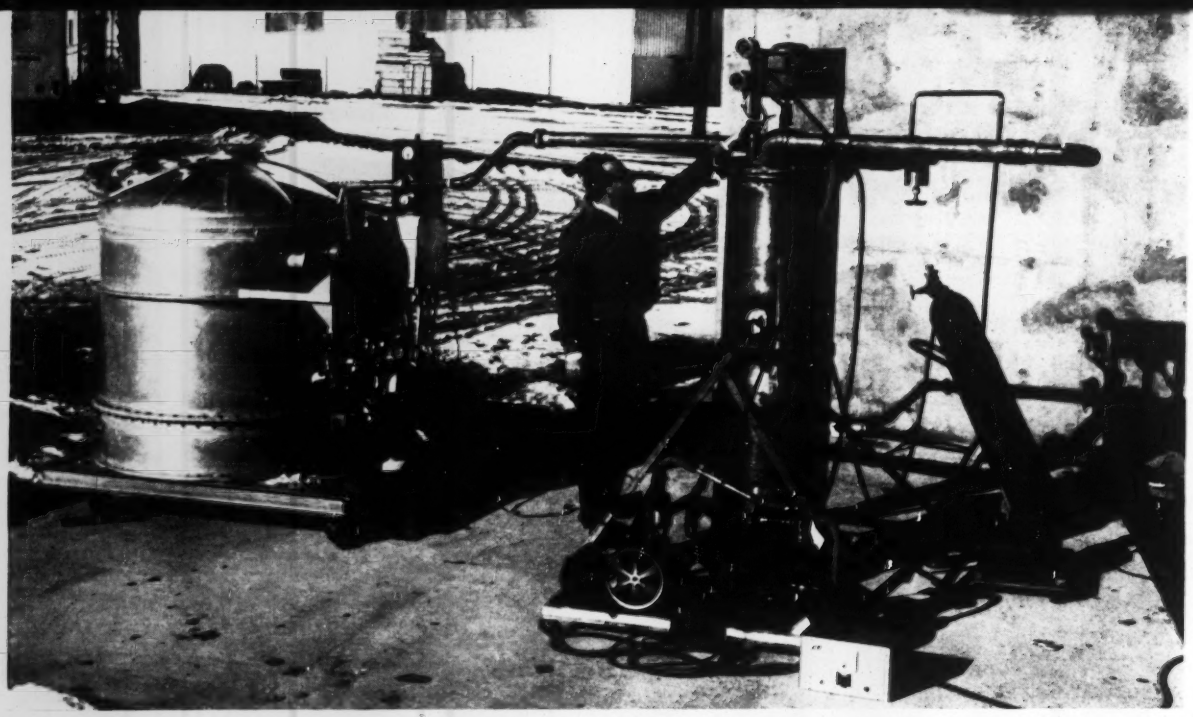
Note that these commercial buildings are located in four or five widely different geographic areas with degree days ranging from 3800 to 6500. This method of analysis looks very promising and offers at least one possibility for predicting expected kilowatt-hours of heat pump installations.

Heat Pump Is Gaining

It is evident from the activity of the air conditioning manufacturers, of the consulting engineers, and of the electric utilities that the heat pump will have a very important and influential position in the future air conditioning market. Three or four of the leading equipment manufacturers already have pre-engineered factory assemblies rated 3 to 500 hp.

Product manual data from these same manufacturers is now available to permit selection of the proper assemblies in order to obtain the necessary heating and cooling capacities. Therefore, the guarantee for the rated capacity of the pre-engineered and factory assembled equipment is assumed by the manufacturer and thus the consulting engineer and mechanical contractor are relieved of this responsibility.

The mechanical contractor, of course, must correctly install the system in accordance with the drawings and manufacturer's instructions, the same as for any other year 'round air conditioning system. ✠



RESEARCH conducted at National Bureau of Standards' Cryogenics Engineering Laboratory at Boulder, Colo., is example of attention being given to this blossoming new field of engineering

Cryogenics: Piping for the Future

Conference hears speakers discuss design of piping systems for transporting liquefied gases at temperatures down to —460 F. Experts describe general fundamentals, pump design and application in missiles and space vehicles, and insulation materials and techniques.

CLOSED CIRCUIT transportation of cryogenic fluids was discussed by Robert B. Jacobs of the National Bureau of Standards' Cryogenic Engineering Laboratory, Boulder, Colo., at a conference held during the annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers at Lake Placid, N. Y., recently.

He defined the field of cryogenics as pertaining to liquefied gases in the temperature range of —250 to —460 F.

In the last 10 years this field—concerned with the application of helium, hydrogen, neon, oxygen, nitrogen, fluorine, and air—has grown to be a multi-million dollar industry. Applications for liquefied gases today are branching into the missile and rocket propulsion areas, thermonuclear power plants, transportation of natural gas (methane), and many others.

Dr. Jacobs explained that the same fundamentals apply in the design of a piping system for cryogenics as with other fluids. However, he pointed out, the properties of the piping materials can be radically different at these low temperatures. Also, insulation requirements are quite different.

He outlined seven areas of cryogenic piping design and installation which are of direct concern to the engineer and contractor:

1) Fluid mechanics (Single-phase flow, two-phase flow, and cool-down)

2) Heat transfer (Insulation and heat exchangers)

3) Pumping requirements (Performance and cavitation characteristics, bearings, and seals)

4) Instrumentation (Flow rates, temperatures, pressures, and tank contents)

5) Storage tanks
6) Valves, fittings, and couplings
7) Properties of materials (Structural materials and fluids).

Considering the single-phase flow design mentioned under item No. 1, he said the system design procedure was more accurate than the two-phase flow, since the phenomena are less complicated. He listed the following bases for the single-phase flow design procedure for a piping system and urged that they be followed:

1) Law of conservation of energy
2) Law of conservation of mass
3) Newton's second law
4) Enthalpy information
5) Elevation information
6) Heat transfer to the fluid (insulation information)
7) Frictional drag on the fluid
8) Loss at the pump
9) Flashing loss
10) Cool-down loss
11) Trapped liquid loss
12) Vapor pressure.

In his presentation, Dr. Jacobs showed the following approximate rates of heat transfer to uninsulated piping containing liquefied oxygen and hydrogen:

Liquid	Ambient conditions (at 70 F)	Heat transfer rate, Btu per hr per sq ft
Oxygen	No wind, 0.10 in. loose frost on lines	330
Oxygen	No wind, no frost	570
Oxygen	Wind, 8 mph, frost	890
Hydrogen	No wind	3300
Hydrogen	Wind, 15 mph	5650

Special Pump Requirements

The subject of pump design for the application of cryogenics in missiles and space vehicles was presented by Louis Schafer, supervisor of cryogenic pump design, Pesco Products Div., Borg-Warner Corp. He pointed out that pumps developed by his company had been for missile and aircraft use and for this reason had been designed to a set of requirements which differ from those used in usual commercial practice. He explained that these pumps must be small, lightweight, and extremely reliable.

Some hydrogen pump design problems to be solved were enumerated by comparing hydrogen properties with those of JP-5 (a kerosene type of fuel) and water. This comparison is given in the following table:

Properties	Hydrogen	JP-5	Water
Density, lb per cu ft	4.4	50	62.4
Boiling point, F	−423	...	212
Heat of combustion, Btu per lb	51,500	18,600	...
Btu per cu ft	226,600	930,000	...
Viscosity, lb per ft-sec	0.7×10^{-6}	8.8×10^{-7} at 100 F	4.58×10^{-4} at 100 F

These properties result in bearing, seal, material, and hydraulic performance problems. To these must be added the fact that hydrogen and air form a combustible mixture in the range of concentrations between 4 and 97 percent of hydrogen with air.

Mr. Schafer cited experiments that have been conducted in an attempt to answer the problems. When a pump and motor were immersed in liquid hydrogen, efficiency of the pump was about 60 percent and it could operate under these conditions for at least 260 hours. No bearing failures occurred as long as flow was constant, he reported.

A question from the floor asked what effect these submerged conditions had on motor capacity. Mr. Schafer replied that the capacity was, in effect, increased. He explained that the resistance of the wire in the motor decreases as the temperature decreases. Actually, the motor size was calculated to be only one-fifth of the normal size required, he said.

Are cavitation problems greater at these low temperatures?, another listener asked. Mr. Schafer answered that cavitation is a function of liquid properties rather than temperature. He reported that there were no signs of cavitation damage and went on to say that the net positive suction head (difference between the pressure at the inlet to the pump and the liquid vapor pressure) was in the favorable range of 2 in. of the fluid being pumped.

Compare Types of Insulation

Insulation materials and techniques for cryogenic systems were discussed by R. H. Kropschot, also a member of the Cryogenics Engineering Laboratory staff. He mentioned several types of insulation and compared their insulating qualities for application in these systems.

High vacuum insulation, he said, is the most common. Radiation is the major factor in this, and Dr. Kropschot explained some of the fundamentals with reference to reducing radiant energy transfer.

He said the lowest emissivity of a surface will also have the lowest electrical resistivity and that emissivity decreases as the temperature of the surface decreases. Also, emissivity increases as the surface contaminants increase. Alloying and work hardening of the metal increase emissivity, he also pointed out.

A new type of insulation consisting of radiation shields separated by good insulation was discussed. Sheets of aluminum foil separated by glass paper have an apparent thermal conductivity of less than 3.0×10^{-5} Btu per hr per sq ft per F between room temperature and liquid hydrogen temperature. This type of insulation offers great promise for insulating vessels for the transport of liquid hydrogen and helium.

Vacuum powder insulations have insulating ability of about 10 times less than the high vacuum insulations. Their heat transfer rate is about 30×10^{-5} Btu per hr per sq ft per F. He said aluminum powder mixed in with these insulations can increase their effectiveness considerably.

Rigid foam material of cellular structure has an insulation value of about 500×10^{-5} Btu per hr per sq ft per F. This type of insulation is not too common for use with liquefied gases.

The need for proper design of supports to prevent conduction from the outer to the inner container is also an important consideration, since one-third to one-half of the total heat gain in the inner chamber where the liquefied gases are may be attributed to conduction through these supports. He concluded by citing plastics as having great promise as a support containing insulation qualities. ≠

Fuel Oil Piping Design Factors Found In "Tobacco Housing" Project Tests

- ***limit horizontal piping runs to 100 ft***
- ***limit vertical lift to 10 ft***
- ***make all pipe joints leakproof***
- ***keep suction and return lines flooded***

• The U. S. Government's dependent "Tobacco Housing" project in England was built on a "crash" program which permitted very little time for advanced planning for heating. Recognizing the first cost and maintenance cost advantages of fuel oil distribution systems to serve groups of buildings, the architect-engineers designed a simple basic system whereby each 10 housing units was fed from a main supplied by a 3000 gal storage tank. The results weren't good. But with a few modifications these bugs were worked out. Of more importance than the success or failure of this installation, however, is the information gained from it.

"Tobacco Housing" is the expression used with reference to an unusual agreement between our State Department and Great Britain to utilize surplus tobacco in financing construction of housing units for U. S. Air Force personnel and their dependents in England. Under the terms of this agreement, 50 million lb of tobacco was sold by the Surplus Commodity Corp. to Great Britain at a price of $15 million. This sum was deposited in England to the credit of the U. S. Government, and was used to defray the cost of constructing dependent housing units at the various air bases.

Mr. McKay is a U. S. Government engineer with more than 19 years' experience in heating, ventilating, and air conditioning design. He has worked overseas for the past four years, presently in Italy in connection with NATO engineering projects. The experience described in this article was gained during two years' residence in England.

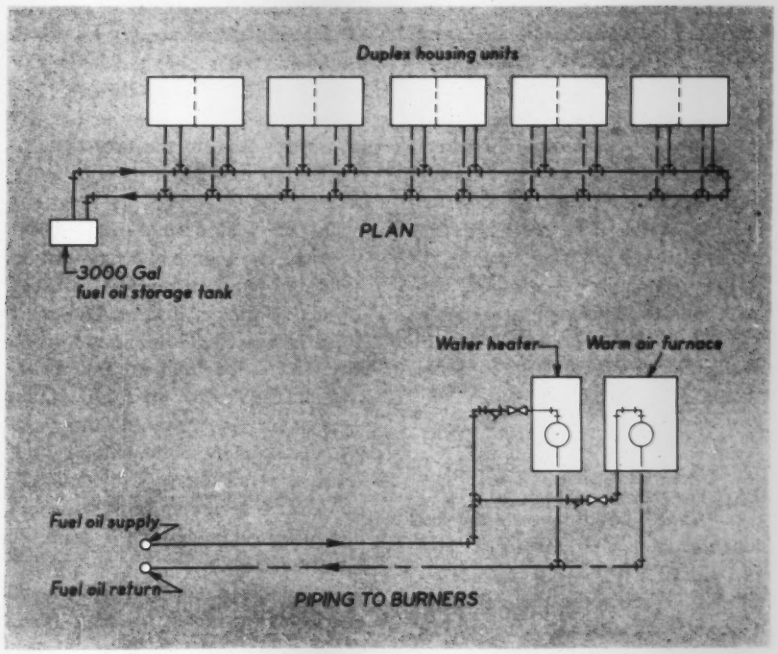
BY JOHN W. McKAY
Mechanical Engineer
Mediterranean Div.
Corps of Engineers
U. S. Army

RECOGNIZING cost advantages of handling fuel oil in large quantities, the U. S. Government chose a prototype central fuel oil distribution system for the Air Force's huge dependent housing project in England.

All utilities are furnished by the Government. Therefore, a fuel oil distribution system, in lieu of individual tanks, delivering oil at a lower unit price per gallon, is a very important item when a contract includes as many as 1500 housing units.

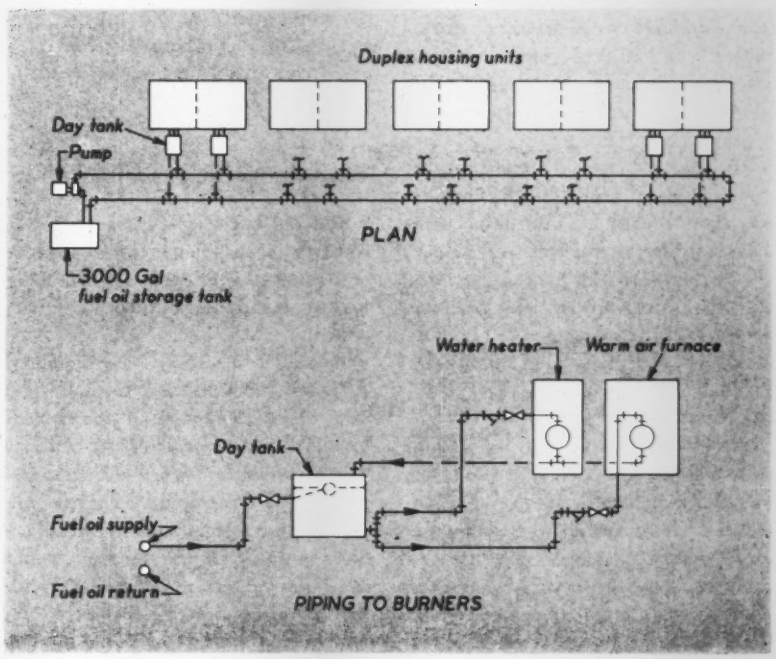
However, a lower unit price per gallon of oil, based on savings in labor of filling individual tanks, is not the only advantage of a fuel oil distribution system. There are also savings in installation costs; for example, the cost of 10 individual 300 gal tanks compared to the cost of one 3000 gal tank. The cost of the distribution mains, of course, would reduce these savings slightly. Other first cost advantages include fewer

Before —



1 ORIGINAL DESIGN was laid out as shown here. Horizontal pipe runs were too long, vertical lifts too great. No provisions were made for fuel oil transfer pumps or booster pumps to keep fuel oil main flooded

After —



2 MODIFIED SYSTEM provides for oil transfer pump to keep return mains flooded and to fill individual 10 gal float controlled day tanks serving each housing unit. System operation has been very satisfactory

pipe fittings, less excavation (this could be an expensive item in rocky terrain), and fewer requirements for calibrated gage sticks or fuel oil level gages.

Likewise, there are savings in maintenance costs for such items as individual tanks with fill, vent, and gage openings; fewer problems of high water tables with related flotation of tanks; and reduced annual labor costs for removing accumulated water and sludge from tanks. Another advantage, difficult to assess costwise, is the reduction in fire hazards, since there are fewer vents to atmosphere, less spillage over a smaller area, and fewer filling operations.

Shortage of Design Data

The idea of distribution systems for utilities, as demonstrated by water, steam, and gas distribution lines,

is very satisfactory because of the nature of the materials involved. However, fuel oil distribution systems, with their inherent problems of sludge, water, providing nonleaking check valves, and maintaining vacuums on the lines, add many factors to be considered in providing a satisfactory design. Basic design data is not readily available.

This particular experience with the "Tobacco Housing" program in England provides some very useful data which should be of interest to other engineers.

Too Little Planning Time

A "crash" building program was launched in which advanced planning played a very minor role. Drawings and specifications were rushed to completion, and construction bids on the program were accepted from two manufacturers of prefabricated housing in the shortest possible time. It was decided to construct one-story, duplex type buildings, with each unit complete in itself. The number of housing units at each site varied between 30 and 210.

The heating system serving each unit consists of an 84,000 Btu per hr oil fired warm air furnace, with ducts leading to registers in rooms. Oil burners are the pressure-atomizing type, direct driven, with built-in, two-stage oil pumps suitable for handling the equivalent of Commercial Standard 12-48, No. 2 fuel oil without preheating.

Since the floors were to be of concrete slab construction and economy was the watchword, it was decided that the air returning to the furnace be permitted to flow by gravity circulation along the hallway corridor. Makeup air is supplied by a duct from the attic space to the floor of the utility room to insure that ample combustion air is supplied.

The utility room, located near the center of the unit, also has an oil-fired water heater. Thus, the problem of fuel oil supply was doubled. The extreme case of 210 units actually represents 420 burners.

To simplify design of the distribution system, the sites were divided into sections or groups of 10 units. Each group of 20 burners was to be fed from a main supplied by a 3000 gal storage tank. Each housing unit was provided with one suction and one return line for the two oil burners, the oil line being divided at the burners.

The original design was laid out as shown in Fig. 1. This typical installation, with approximately 950 ft of suction line, had a maximum lift of 19 ft, 6 in. from the bottom of the fuel tank to the highest unit on the system. The lowest oil fired unit on the system was 6 ft, 6 in. lower, giving a maximum suction lift of 13 ft. Prior to tests, the fuel oil tank was tipped at 6 ft, reducing these suction lifts to approximately 13 ft, 6 in. and 7 ft, respectively.

In this arrangement there were no provisions for fuel oil transfer pumps or booster pumps to keep the fuel oil main flooded. Each burner was loaded with a maximum suction from the storage tank in addition to other sections of the piping system which could conceivably be empty of oil or leaking at any time.

Tests Reveal Shortcomings

During initial tests a number of construction deficiencies were discovered and it was necessary to delay further testing until they were corrected.

Remedial measures were applied. After all pipelines had been flushed out, filters cleaned, and the system tested at 50 psi for 24 hr without loss of pressure, tests were again resumed. All units could be started by priming the system with a semi-rotary hand pump and the burners would continue operating indefinitely with the automatic controls cut out of circuit. That is, the room thermostats were set at 90 F with all windows open, and the hot water taps were open so that the water heaters were continually in operation.

During the final test, the system was primed and all units were fired up at 9:30 a.m. At 11:45 a.m., windows were closed, thermostats reset to 70 F, and hot water taps were closed. Within a few minutes all the furnaces closed down except one. (This one was later found to have a faulty thermostat.)

At 11:55 a.m., one water heater closed down by thermostatic control, and, after a few minutes' delay, was brought into action by running the hot water to waste. The burner immediately attempted to start, but failed to ignite and the automatic control locked out on flame failure. During this same period the other water heaters were closing down. By 12:15 p.m., the last of the water heaters locked out on flame failure. The last burner to stop functioning was the one with the least suction lift. This was obviously kept operating by drainage of the suction line from higher levels.

Attempts to start the burners under these conditions were very hazardous, as the fuel pumps passed a certain amount of vapor which caused minor explosions in several of the furnaces.

Some Basic Design "Don'ts"

These tests demonstrated a number of basic design deficiencies:

1) Excessive horizontal runs of piping. Good heating practice would have limited horizontal piping runs to 100 ft, instead of the 950 lineal ft installed.

2) Excessive vertical lifts. In this particular system, good practice would have limited the vertical lift to 10 ft maximum.

3) Use of tighter screwed pipe joints. Either welded joints or tighter screwed pipe joints throughout the system would have prevented the loss of vacuum due to leakage at the fittings.

4) Dependence upon check valves to maintain a perfect seal. An adequate vacuum on the system, maintained by check valves, is not practicable, considering the amount of scale and sludge in the average oil piping system.

Modified System Cures Ills

After lengthy tests and considerable delay, a revised piping arrangement was developed as shown in Fig. 2. This revised arrangement provides

for a fuel oil transfer pump to operate continuously to keep the suction and return mains flooded and to fill individual 10 gal float controlled day tanks for each housing unit. Separate suction lines are provided from the tank to the water heater and furnace. A common return line carries excess oil back to the tank.

The float control in the day tank operates to maintain a constant reservoir of fuel for the burners at a maximum lift of 3 ft. Individual suction lines eliminate the difficulty of leaking check valves from adjacent unfired burners.

This modified system proved to be very satisfactory and has operated for some time with a minimum of maintenance even though the constantly running fuel oil transfer pump and the float controls are critical maintenance items. ∓

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says:

"Modified System Serves Tenants Well"

RECENTLY, I encountered a large apartment building provided with a vacuum steam heating system designed 30 years ago. There were two stoker fired boilers and the steam circulation was down-feed, with unusually large horizontal main pipes in the attic and with very small horizontal condensate pipes in the basement.

Some of the horizontal return pipes were buried under the basement floor. The basement is largely used for tenants' storerooms and laundries. The buried pipes eventually rusted out or clogged and required replacement with overhead pipes.

Each room in these high quality apartments had but one steam radiator and this radiator had not been responsive to individually modulated temperature control for some time.

An attempt was made to control the operation of the stokers in response to an outdoor thermostat, but there were so many rooms of widely variable size and with such different orientations, that automatic temperature control was not possible. With the replacement of the steam pipes, it was decided to install a mechanically circulated hot water system.

Using hot water in the remaining parts of the system presented certain problems which were solved by removing the restrictions in the vacuum traps and providing air separating vents, together with an expansion tank. The distribution of the hot water was equalized by installing new supply valves on the radiators.

A circulating pump was able to force the returning, partly cooled water through the relatively small former condensate return risers for the radiators on all three stories. We balanced the water distribution for the widely different sized heat transmitters with a new flow valve at each radiator which, once adjusted, may stop the water flow but cannot be opened so widely as to upset the permanent distribution.

It was necessary to install new overhead horizontal return mains to replace the old, partly clogged underfloor pipes. However, it was not necessary to increase the size of the old vacuum return risers.

The building now is heated with hot water, even though the change did involve some investment in the new flow valves, pump, and expansion tank. There was no inconvenience to the tenants in the various apartments during this changeover. The modified heating system for this large apartment is serving the tenants now very well. ∓

Case Histories from a Consulting Engineer's Files

By C. T. BAKER
Consulting Engineer

Modern heating, piping, and air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here are four typical cases from the author's experience where original design was faulty and had to be corrected.

• case of the pounding compressors

TWO REFRIGERANT No. 12 compressors were installed to supply air conditioning for a two-story structure. The compressors were started and stopped by thermostats. When either unit started in response to the thermostat, severe pounding occurred, causing much of the piping to vibrate. Several leaking joints developed, causing considerable loss of refrigerant.

As solenoid valves had not been installed on the liquid supply line to the air cooling units, the coils of these units filled to capacity with liquid during the off period of the compressors. When starting, this liquid flooded the compressors and caused the pounding. The situation was corrected when solenoid valves were installed to close with the stopping of the compressor and open when the thermostat called for cooling.

The water supply to the condensers was such that the condensing water pump operated only in response to one compressor. Consequently, when the compressor which controlled the operation of the pump stopped in response to the thermostat, the pump stopped also, even though the other compressor was still in operation. This caused excessive condensing pressures which prevailed until the high pressure cutout acted to stop the second compressor.

A re-wiring of the controls corrected this condition.

• drain valves remove entrapped oil

OF A TOTAL of eight suspended type fin coiled air cooling units serving a large industrial plant, none were equipped with oil drains for removing entrapped oil. A gradual falling off in output of these units over a considerable period of time prompted the installation of drain valves so arranged as to permit easy access.

The idea that the velocity of the refrigerant passing through such units is always great enough to carry all entrained oil with the refrigerant is wrong and should be forgotten.

• owners penny wise, pound foolish

THE OWNERS of a two-story structure decided to provide summer air conditioning for the comfort of their tenants. Bids were requested from several contractors. Since the owners were laymen and not engineers, they were at a very great disadvantage when it came to comparing and analyzing the bids submitted.

After a couple of days' study, the owners awarded the contract to the low bidder who was $300 under his nearest competitor. Two 5 ton refrigerant No. 12 compressors were installed and so wired that if and when one unit could not carry the load during periods of maximum cooling demand, the second unit was started

automatically.

When signing the contract, the owners overlooked several important factors: First, being laymen, they were unable to tabulate and analyze the several proposals submitted. Second, they failed to consider the question of condensing water supply. They also insisted upon a location not at all suitable for the machinery and equipment, claiming that it was the only space available.

Shortly after the plant was placed in operation, the owners complained to the contractor that, when starting up, the compressors made a terrible pounding noise. The contractor replied that this was not unusual and was to be expected of reciprocating compressors but would do no harm.

City water was used as the condensing medium. After it passed through the condenser, the water was dumped into the sewer. When the owners received their first month's water bill, they hit the ceiling. Even though one compressor had handled the cooling load, operating only part of the time, the cost of the water used was sky high.

Since it would be impossible to continue the use of city water for condensing purposes, it was decided to install a cooling tower. Since the original contract did not include a tower, the cost of the addition had to be assumed by the owners. The contractor was retained to supply and install the tower, together with a condensing water pump and the necessary water piping.

While the cooling tower solved one problem, it brought a new one in its wake: the control of the condensing water pump. When compressor No. 1 was handling the load singly, no trouble was experienced since, when the compressor was stopped by the thermostat, the pump would also come off the line. However, when the second compressor was on the line during periods of maximum cooling demand, it had to operate without benefit of condensing water if it should be the second to close down, since the condensing water pump was shut down by the stopping of No. 1 compressor.

In a short time, with no water circulating through the condenser, the condensing pressure would soon reach the high pressure cutout point and be stopped.

Before the proper sequence of operation could be established, a complete rewiring of the controls was necessary. At the close of the initial cooling season, the following changes were made:

1) A solenoid valve was placed on the main liquid line supplying the air cooling units. It was wired to close the supply of liquid to the cooling coils with the stopping of the compressor. This eliminated the pounding of the compressors when starting, since the instant both compressors came off the line, the solenoid would close. Before the solenoid valve was installed, liquid would continue to flow into the cooling coils, filling them to capacity. Later, when the compressor would start, it handled nothing but raw liquid until the evaporators were evacuated.

2) A hand shutoff valve was placed on the suction outlet connection of each air cooling unit. This could be closed when necessary to open a compressor for inspection. By closing the hand valve at the evaporators, the suction line could be pumped out to prevent the loss of refrigerant in case the stop valve at the compressor failed to seat tightly.

3) A strainer was placed in the main liquid line at both the inlet and outlet ends of the refrigerant drier that had been installed in the liquid line between the condenser and the thermal expansion valves at the evaporators. A full sized bypass was installed around the drier and strainers which permits the removal of the drier for recharging when necessary and the removal of the strainers for cleaning.

4) A strainer was placed in the suction line near the condensing water pump to protect the pump against the entry of foreign matter.

5) Since no pressure gages had been provided with the equipment, a metal gage board was installed to which was fitted two suction and two discharge pressure gages.

6) To permit the scraping of condenser tubes, an opening was provided in the building wall next to the cleanout end of the condenser, which was located within 18 in. of the wall.

When interviewed later by this writer, two of the unsuccessful bidders displayed their proposals which disclosed that they had included in their bids most of the items that had to be installed *following* the first season's operation.

• horse sense can save us plenty

A 30 TON capacity atmospheric spray tower in a refrigerating plant was located opposite seven stacks serving a sausage smoke house. The prevailing winds were such as to carry the smoke from these stacks to the cooling tower.

As the smoke mingled with the spray water in its descent through the tower, some of the CO_2 was absorbed by the falling water which, along with absorbed oxygen, created a very serious acid condition, one calculated to cause excessive corrosion of piping and condenser tubes.

Corrective measures are being taken to remove this agency of destruction. Yet this is perhaps one of many similar situations that have taken a hidden toll in the form of corrosion.

Why are such wasteful practices permitted to exist in this enlightened age? No doubt, the answer is found in the fact that not enough people in responsible charge of production and plant operation are energetic enough to apply some horse sense to their operations. Laziness, ignorance, indifference, and rule of thumb procedure are costing industry great sums of money annually — money that could be saved if enough interest were shown by responsible persons in knowing what is going on in their plants, and why. ≠

INDUSTRIAL VENTILATION:

Proper Inplant Environment Essential To Worker Comfort, Product Quality

Speakers at conference discuss the general design requirements of ventilation systems for modern industry, the ever-increasing importance of dust and fume control, the progress made by the steel industry to provide better conditions for its workers, and the use of shielding as a control for radiant heat emitted from hot plant equipment and processes

DESIGN REQUIREMENTS for industrial supply air systems were presented at an industrial ventilation conference held at the recent meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers at Lake Placid, N. Y.

Speaking before the group, John H. Clarke, supervisor of air conditioning and power, Visking Corp., pointed out that ventilation and air conditioning in industrial plants is no longer a luxury. Instead, it is an important, and in some cases, an essential item for production.

He explained that there are several reasons for this. One is that the demands for plant production efficiency have been growing. Air conditioning and mechanical ventilation are very important factors toward this end in present-day large single-story plants having high internal heat loads where desirable environmental conditions for workers and for the product are necessary. Another reason is that there has been a greater concern in recent years for the safety and comfort of workers.

Mr. Clarke pointed out that the design of a good industrial ventilation system begins with the preliminary design of the plant, process, and building. As another primary factor, exhaust hoods should be carefully designed to reduce their makeup air requirements to the minimum. He also felt that, for good design, large glass areas should not be permitted in present-day plants, and that hot equipment should be shielded or insulated to reduce the ventilation load by changing the design or process. He stressed the need for some reasonable provisions to gain access to the equipment for maintenance.

Cites Design Requirements

In designing system components, he said the engineer should:

1) Locate the system where it can be maintained.

2) Locate the intakes to minimize intake of dust and fumes.

3) Allow adequate space in each system casing compartment for inspection, repair, and to facilitate uniform air flow.

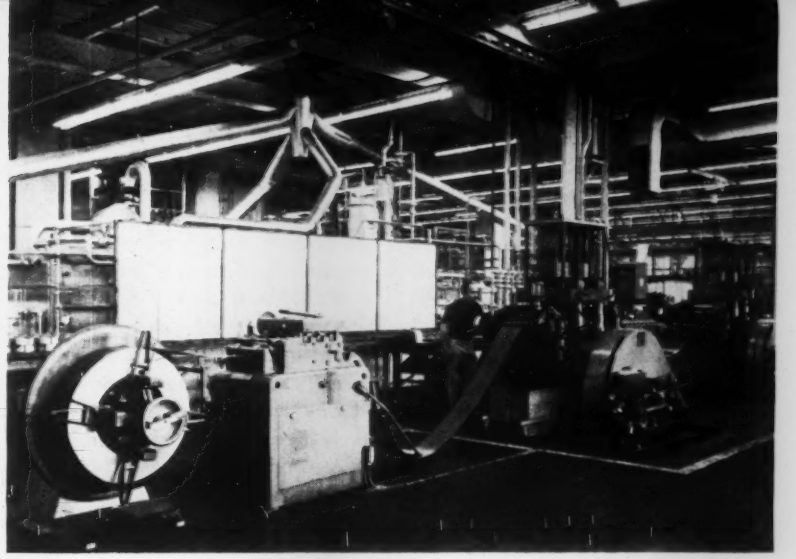
4) Provide good temperature control.

5) Provide freeze protection by mixing return air to have air entering the heaters uniformly.

Mr. Clarke stated that the physiological requirements for the industrial worker should be known by the engineer before designing the system. Such measures of conditions as heat stress index and effective temperature should be determined for the specific working conditions. In this connection, the desirable air motion on the worker will vary from 50 to 100 fpm for fully air conditioned or partially cooled supply systems. A maximum velocity of 200 fpm has been established for continuous exposure at fixed working positions, he said.

For spot cooling, he pointed out that velocities as high as 4000 fpm have been used for intermittent exposure. These are maximum velocities, and the worker should be able to reduce them as desired.

For ordinary makeup supply air systems, very little or no ductwork is required unless these systems provide heat relief or if the air motion is too great for the worker. However, in air conditioned spaces or in areas where general relief ventilation is used, duct distribution is required for controlling the space conditions. He pointed out that horizontal runs



RADIATION SHIELD increases comfort to worker. Supply outlet introduces air down to occupied zone, following recommended methods presented by speakers at this conference

at low level may be provided where it is possible to hang ducts. Spot cooling requires much less ductwork, because relief is provided at the work stations only.

In the case of relief systems, the environmental conditions of the worker are most important. To accomplish the desired results, the supply air must be delivered to the work zones, he said.

Select Outlets to Fit the Job

In describing supply outlets and their uses, Mr. Clarke said the characteristics of the various kinds of outlets should be fitted to the specific installation. He also listed three other factors that should be considered:

1) The supply outlets should have some means of volume control so the worker can adjust the air flow to meet his needs.

2) Heat relief is often necessary at outside temperatures well below acceptable supply air temperatures.

3) Where systems provide essential makeup air, means should be provided to reduce the air supplied to the work zone when desired, without affecting the volume of makeup air to the general plant area.

Mr. Clarke concluded his presentation by outlining the desirable applications for various outlets, such as diffusers, slots, and perforated panels.

(Mr. Clarke is the author of an extensive series of articles on industrial ventilation published in recent months in Heating, Piping & Air Conditioning.)

Greater Need For Dust Control

The subject of dust and fume control systems was presented by Peter J. Marschall, manager of engineering, Abbott Laboratories. Proper ventilation and air conditioning, he said, are becoming more and more important in the manufacture of drugs and medicines.

He defined the various types of contaminants that must be controlled within the plant — such as dusts, mists, vapors, gases, and fumes—and outlined the necessity of creating an acceptable environment for workers by safeguarding the on-the-job health of the workers and for the manufacture of quality-controlled products.

He said the importance of controlling dusts, vapors, and gases to minimize fire and explosion hazards should not be overlooked. He pointed out that insurance underwriters generally specify minimum standards of ventilation and if an owner does not meet these standards it may not be possible for him to qualify as an insurable risk.

Mr. Marschall pointed out that some of the air handling problems with new chemical compounds are quite complex. Often, the design of the ventilating system must be resolved before production can begin. If the cost of removing the contaminants is too great, the product itself may be changed or other manufacturing methods considered.

Speaking on the subject of air pollution, he said there are a number of factors to consider in selecting the proper equipment for treating the contaminants. If the material is a dust and is valuable, a dry cyclone collector or bag type collector is used. Often, static pressure regulators are used to maintain reasonably constant volumes of air flowing for close control of the air exhausted from an air conditioned area.

If recovery of the contaminant is not economically practical or desirable, a wet type of collector is used. At Abbott Laboratories, a separate chemical drain line is used to carry the wastes to a waste treatment plant.

Mr. Marschall showed a number of examples of localizing the contaminant by enclosing the operating area and removing it by the exhaust air directly. The cost savings in applying this principle have been very significant, he said, in several cases the quantity of makeup air being reduced 30 to 50 percent, representing savings of $4000 to $18,000 in annual operating costs.

Refrigeration capacities for air conditioned work areas have been reduced appreciably when the process areas have been enclosed so that the contaminants could be removed directly. In this way, makeup air is

introduced directly to the hood area without treating or conditioning it.

Traces 35 Years' Progress

Ventilation in the steel industry was discussed by Fred E. Tucker, industrial hygienist, Weirton Steel Co., by reviewing the development of environmental conditions from 35 years ago to the present day. Methods of providing acceptable comfort conditions for steel workers, he said, have evolved from gravity air circulation in open type buildings, to roof monitor type ventilators with tighter construction, to small individual heating and ventilating units. Too little attention has been given air distribution, he said. At last, good air distribution practices have recently been applied where employees are able to derive the benefits of conditioned air.

Mr. Tucker said that four basic qualifications for environmental control are required in his company's operations. These systems must:

1) Eliminate the need for small individual heating and ventilating units

2) Supply at least 2 cfm of make-up air per square foot of floor area

3) Provide thermostatic control

4) Distribute the air to achieve the maximum value.

Mr. Tucker stated that the installation cost for systems in his company's new plants, where 348,000 cfm is circulated, was less than 50 cents per cfm. Twelve such plants require a total of over 2 million cfm.

Air conditioning in some form will be the next step in the improvement of environmental conditions for industrial workers, he predicted, citing evaporative cooling as the most likely next step since cooling by mechanical refrigeration is often too costly except under unusual circumstances. In concluding, he suggested that the problems of tomorrow be carefully considered in the designs being made today to keep pace with increasing maintenance costs.

How to Control Radiant Heat

Control of radiant heat in industrial plants was discussed by W. G. Hazard, Owens-Illinois Glass Co. He pointed out that infra-red radiation should be one of four primary factors considered in providing an acceptable environment for the worker. The others are air velocity, air temperature, and relative humidity.

Mr. Hazard showed how to measure radiant heat by means of a globe thermometer and explained how the mean radiant temperature (MRT) can be determined if the air velocity is between 25 and 50 fpm. Under these conditions, he said, the MRT is midway between the temperature of the hot surface and the ambient air temperature. He went on to explain how shields may be used to reduce the radiation as much as 60 percent (but not 100 percent, as some may believe.) Shielding is also used to protect certain operating equipment from radiation emitting from other equipment operating at higher temperatures, he explained.

The nature of the shield should be considered very carefully to obtain the maximum benefit. This should be done to keep the shield from passing radiant heat on after receiving it from the hot source. Aluminum, a good reflector and a poor emitter of heat, may be used as shielding material, he suggested. The shield should be located so that it is not in contact with the hot source to receive heat by conduction, and so that it does not affect the normal air circulation in the space and does not interfere with air supply ducts and outlets.

Mr. Hazard emphasized that workers in the area of the shield be instructed regarding the purpose of the shielding so that they understand why it is there. This, he said, will help prevent misuse of shields and will help greatly in increasing the comfort for the worker. It will also help to keep shields clean so that they remain effective, he said. Also, when they are removed in the winter, they should be stored carefully so they can be used again, rather than thrown into some corner where their reflectivity cannot be preserved.

He concluded by citing some examples of the use of infra-red reflecting glass as a radiant heat barrier where transparency is needed.

Cite Locker Ventilation Data

Following the speakers' presentations, the meeting was opened for discussion. Asked for information pertaining to the ventilation of lockers for workers in industrial plants, Mr. Clarke cited three classes of locker ventilation requirements:

1) Hang-up room, where workers' clothes are relatively clean and no odors need be carried away. A ventilation rate corresponding to a 10 min. air change has been found to be adequate as a general rule.

2) Manual labor locker room, where workers' clothing needs to be dried out and an odor problem exists. For this condition, an air flow rate of 7 cfm per locker and a 6 min. air change in the space are adequate. This can be introduced into the bottom of the locker and out through the top.

3) Heavy labor locker room, where odors from chemicals, oils, etc., are more severe. For these conditions, an air flow rate of 10 cfm per locker and a 3 min. air change rate in the locker room should be used, he said.

Another question concerned the use of air-to-air heat recovery systems in large plants where large quantities of air are supplied. Mr. Clarke replied that it is desirable to recover as much heat as possible to keep the operating costs to a minimum. Some plants are finding this worthwhile, he said.

Mr. Hazard was asked about the desired spacing of the radiant heat shield from the source to obtain the maximum benefit for the worker. He said there was no fixed relationship, but the shield should be just far enough away from the source to block off the line of sight to the worker but not reduce convection currents on the hot side of the shield.

Walter Holt, Buffalo Forge Co., pointed out that shielding is just one way to control radiant heat. Ventilation should be used, also, to carry as much heat away as possible, he said. ≠

Steam Pipe Sizing Data

THIS STEAM pipe sizing data, just recently made available for publication, is appearing in HPAC Data Sheets in four parts, concluding in the September issue. The first part was published in June.

All tables are based on dry steam flowing through Schedule 40 steel pipe. The Moody Friction Factor has been used in computing pipe capacities and friction losses.

Table 3, below and continued on the next page, is a tabulation of friction losses per 100 linear ft of pipe, or the equivalent. For pipe sizes 1 in. to 2½ in., see the July Data Sheet.

This data is being published through the courtesy of the Nash Engineering Co.

TABLE 3—FRICTION LOSSES per 100 linear ft of pipe in sizes 3 in. to 16 in. are tabulated below and on next page. Data is based on steam at 5 psig initial pressure. Pipe is Schedule 40 steel. Loads are in square feet of equivalent direct radiation and in pounds per hour. Velocities may be calculated by using factors at bottom of each page

PRESSURE LOSS OUNCES - PER 100 FEET OF STEEL PIPE						
LOAD SQ.FT.EDR	PIPE SIZE - INCHES					LOAD LBS. PER HOUR
	3"	3-1/2"	4"	5"	6"	
1300	.97					325
1400	1.11					350
1500	1.26					375
1600	1.42					400
1700	1.60					425
1800	1.77	.87				450
1900	1.95	.96				475
2000	2.16	1.05				500
2200	2.57	1.26				550
2400	3.04	1.48	.80			600
2600	3.53	1.71	.93			650
2800	4.05	1.96	1.06			700
3000	4.60	2.23	1.21			750
3200	5.2	2.51	1.36			800
3500	6.1	2.99	1.61			875
4000	8.0	3.82	2.06			1000
4500	9.9	4.76	2.57	.83		1125
5000	12.1	5.8	3.13	1.01		1250
5500	14.6	7.0	3.74	1.20		1375
6000	17.2	8.2	4.41	1.42		1500
6500	20.1	9.6	5.2	1.64		1625
7000	23.2	11.1	5.9	1.89		1750
7500		12.6	6.8	2.14	.87	1875
8000		14.3	7.7	2.42	.98	2000
8500		16.1	8.6	2.71	1.09	2125
9000		17.9	9.6	3.02	1.22	2250
10000		22.0	11.7	3.69	1.48	2500
11000		26.4	14.1	4.43	1.77	2750
12000			16.6	5.2	2.09	3000
13000			19.4	6.1	2.43	3250
14000			22.3	7.0	2.79	3500
15000			25.5	8.0	3.18	3750
16000				9.1	3.60	4000
17000				10.2	4.02	4250
18000				11.3	4.50	4500
19000				12.6	4.98	4750
20000				13.9	5.5	5000
22000				16.7	6.5	5500
24000				19.9	7.8	6000
26000					9.1	6500
28000					10.5	7000
30000					12.0	7500
32000					13.6	8000
35000					16.2	8750
40000					21.0	10000
45000					26.4	11250

VELOCITIES

TO OBTAIN VELOCITY IN FEET PER MINUTE, MULTIPLY LOAD IN SQ. FT. EDR BY PROPER FACTOR SHOWN BELOW:

	PIPE SIZE - INCHES				
	3"	3-1/2"	4"	5"	6"
FACTOR	1.655	1.235	0.960	0.610	0.425

HPAC DATA SHEET

TABLE 3—(Continued)

PRESSURE LOSS OUNCES - PER 100 FEET OF STEEL PIPE						
LOAD SQ.FT.EDR	PIPE SIZE - INCHES					LOAD LBS.PER HOUR
	8"	10"	12"	14"	16"	
14000	.72					3500
15000	.82					3750
16000	.92					4000
17000	1.03					4250
18000	1.15					4500
19000	1.28					4750
20000	1.41	.45				5000
22000	1.69	.54				5500
24000	2.00	.63				6000
26000	2.33	.73				6500
28000	2.68	.85				7000
30000	3.06	.96				7500
32000	3.45	1.08				8000
35000	4.10	1.29	.55			8750
40000	5.3	1.66	.69	.43		10000
45000	6.7	2.07	.86	.54		11250
50000	8.2	2.53	1.05	.66	.34	12500
55000	9.8	3.04	1.25	.79	.41	13750
60000	11.6	3.59	1.48	.93	.48	15000
65000	13.5	4.20	1.73	1.08	.55	16250
70000	15.6	4.84	1.99	1.24	.64	17500
80000	20.3	6.3	2.58	1.60	.83	20000
90000		7.9	3.23	2.00	1.04	22500
100000		9.6	3.96	2.45	1.26	25000
125000		14.9	6.1	3.78	1.94	31250
150000			8.6	5.3	2.77	37500
175000			11.7	7.2	3.71	43750
200000				9.4	4.82	50000
225000					6.0	56250
250000					7.4	62500
275000					8.9	68750

VELOCITIES

TO OBTAIN VELOCITY IN FEET PER MINUTE, MULTIPLY LOAD IN SQ. FT. EDR BY PROPER FACTOR SHOWN BELOW:

	PIPE SIZE - INCHES				
	8"	10"	12"	14"	16"
FACTOR	0.244	0.155	0.109	0.0905	0.0692

the law and your profits

JOHN F. MORRISSEY takes over this month as author of this regular feature. As an attorney at law, he has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Buyer Rescinds Contract — Then What?

WHEN a purchase contract is rescinded by the buyer because of defective merchandise, each party to the contract must beware of his respective duties and rights, as is illustrated in the following case:

Cecil Frost, proprietor of a drug store, purchased a packaged air conditioning unit from the Easy Weather Co., air conditioning contractor, to cool his place of business. He signed an agreement whereby he would pay one-third down and the balance within 60 days after delivery. The agreement contained no provision reserving title in Easy Weather.

On August 2, the unit was installed and placed in operation in Frost's store. Less than a week later, he found that he was completely dissatisfied with its cooling effects. After using it for several days more, he consulted with his neighboring friend, the owner of an adjacent shoe store. Together, they concluded that the unit was defective.

Determined to rectify the situation, Frost, on August 13, addressed and mailed a registered letter to the Easy Weather Co., stating that he was cancelling and rescinding the purchase agreement and that no further payment on the unit would be made until the defect was cured or a new and properly working unit was installed.

Two weeks passed and Frost heard nothing from Easy Weather. Again he decided to consult with the merchant next door. This time they agreed that, even though the unit was defective, the friend would purchase it from Frost for one-half the original purchase price.

They called in another contractor to move the unit and place it in operation in the shoe store.

The following day Frost was greeted at his door by two men from Easy Weather who were prepared to remove the defective unit and replace it with a fully efficient one. Frost explained that he was sorry but he had sold the original unit. The two men returned to their employer who proceeded to file a lawsuit against Frost for the agreed purchase price.

Easy Weather argued in court that Frost's act of selling the unit constituted an acceptance of the original sale and he was, therefore, liable for the full purchase price.

Easy Weather contended further that if the contract to purchase was, in fact, rescinded, then ownership to the unit reverted back to Easy Weather and Frost had no right to deprive the company of ownership.

Frost contended that he had done all that a man could reasonably be expected to do.

"After all," he said, "I heard nothing from the company for over two weeks after I had rescinded the purchase. I did only what was practicable under the circumstances. I had paid money down on a defective unit and I had a right to recoup my loss by selling it."

The court, in reaching its decision, stated that, if a buyer resells or attempts to resell merchandise without first notifying the original seller that he is rescinding the contract because of defects, such an act is sufficient acceptance so as to render the buyer liable for the full purchase price.

On the other hand, the court held, if the seller, after receiving notice of the defects, refuses to take back the merchandise or fails to give instructions as to the disposition to be made of it, the buyer has the right to resell it and is then only liable for the proceeds less the amount he has already paid the original seller.

The court held that Easy Weather failed to act upon the rescinded contract within a reasonable length of time and, therefore, Frost had acted properly in selling the unit.

But all was not lost for Easy Weather. Under the court ruling, it received the proceeds of Frost's sale to his friend, but only after Frost withheld the amount of his original down payment. This, however, didn't compensate Easy Weather for the loss of even a defective unit and the expenses of litigation.

When a buyer rescinds a purchase because of defective merchandise, the seller should act with dispatch to protect his interests. ÷

BY R. LESTER SPITZLEY
Vice President
and
W. A. BROWN
Project Engineer
R. L. Spitzley Heating Co.

Contractor Observes "Quiet" In Installing Hospital Cooling

To drill 2550 holes, each 6 in. thick, through reinforced concrete floors to air condition Detroit's Henry Ford Hospital—and not disturb patients with the noise—this mechanical contractor used a technique which completed the job quickly, neatly, and with minimum interruption of hospital operations.

INSTALLING an air conditioning system in the Henry Ford Hospital, Detroit, meant drilling holes through reinforced concrete with a minimum of noise, dirt, time, and cost and without interrupting hospital services.

The mechanical (heating, piping, and air conditioning) contractor also had the contract to install the air conditioning system in the recently built 17-story addition to the hospital. This was completed before moving into the older building to install the induction air conditioning system with 850 units.

The drilling job called for 2550 holes through reinforced concrete floors 6 in. thick. About 850 holes 9 in. in diameter were to be drilled

AVERAGE DRILLING TIME for each hole at Ford Hospital averaged 20 min., plus another 10 min. for setup and 5 min. to remove core. Water for flushing away cuttings was provided from portable pressure tank. Vacuum unit picked up water and debris quickly, effectively

TELESCOPING POST anchored drilling machine between floor and ceiling. This method of bracing afforded rigidity without damaging plaster

for the sheet metal ducts. Another 1700 holes 3 in. in diameter were to be drilled for hot and chilled water supply and return piping.

Drilling was accomplished using a portable one-man operated machine with a telescoping post which was anchored firmly between the hospital floors and ceilings. This post is mounted in a heavy cast base with two 6 in. rubber wheels for quietness and easy maneuverability.

Average drilling time for each hole was 20 min. Add to this another 10 min. for setup and 3 min. to remove the core and the average time required to complete each hole was 33 min. Water for flushing away cuttings was provided from a portable pressure tank. A vacuum unit with a tank on wheels picked up water and cuttings in and around the cavity quickly and effectively.

Patients were temporarily moved out of the immediate working areas during the installation, but otherwise there was no disruption of hospital services.

Extend Risers to New Floors

Shortly after the work in the building was underway, construction began on two new floors on top of the patient areas to increase the capacity of the hospital to 1100 beds. Capacity had been provided in the equipment, mains and risers, so that it was a comparatively simple matter to extend the risers to the new construction.

A little tougher problem was the revision of, and addition to, the toilet and kitchen exhaust systems, plus the installation of new fans in fan rooms on the sixth floor roof while still keeping the hospital in operation.

A new 900 hp, 4800 volt, electrically driven centrifugal refrigerating machine was installed to handle the additional load of the patient areas. The condenser water for this compressor is supplied by a ground level cooling tower installed at the rear of the 20-acre site. The condenser water is pumped through 12 in. underground mains by a 60 hp vertical turbine pump.

This new machine is interconnected with the existing two centrifugal compressors to provide 2600 tons of cooling capacity for buildings on the site.

Remove Existing Heating Mains

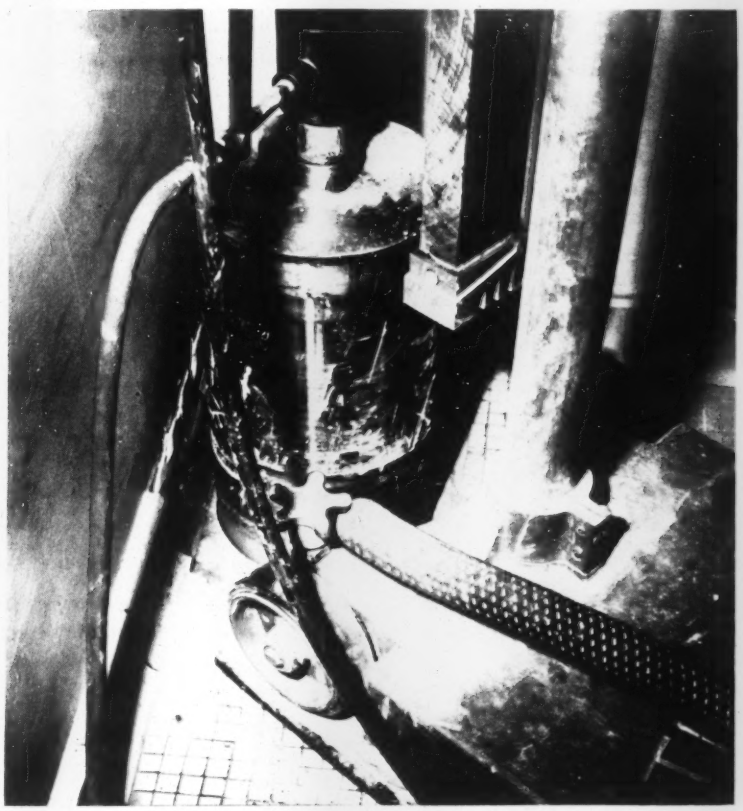
The original four-story, 870 bed patient building had been heated by a circulating hot water system since its completion in 1917. It was necessary to remove the existing heating mains and large ventilation supply ductwork in the basement corridor ceiling to provide space to install the new dual temperature water system and the new 18 in. diam air supply system.

Two mechanical rooms in the basement, which originally had contained air washers for ventilation of patient areas, accommodate the new air handling apparatus of the perimeter system. Four separate heating and ventilating units are in basement laundry separating rooms for the ventilation and conditioning of the interior stations for nurses.

The additional two floors follow the same general pattern of the existing patient areas, with the exception of a new maternity section on the sixth floor at the west end of the building.

This area contains delivery and recovery rooms and nurseries which require special ventilation treatment. These special rooms are supplied by a separate heating and ventilating unit which maintains the correct humidity and temperature conditions required in areas where hazardous gases are used. Labor and patient rooms in this area are connected to the basic perimeter system.

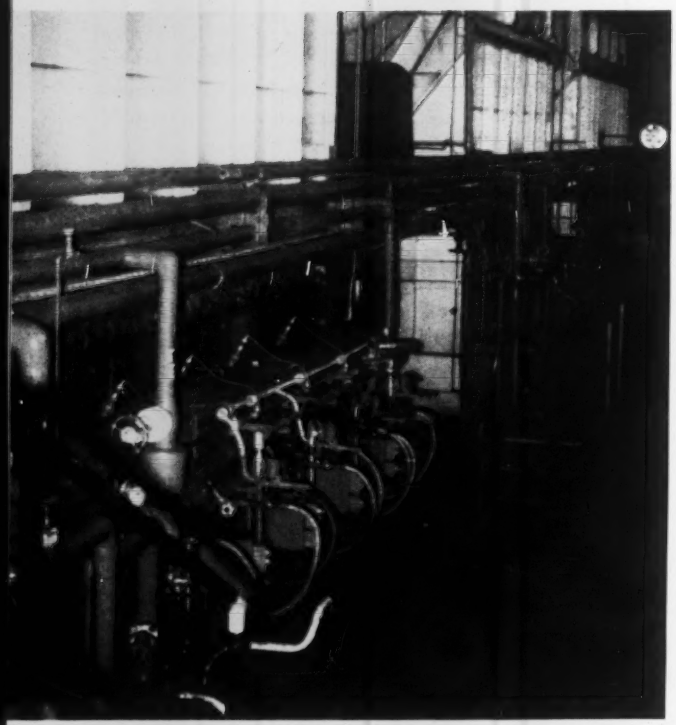
The mechanical (heating, piping, and air conditioning) contractor was the R. L. Spitzley Co. ‡



TO AVOID DAMAGE to suspended ceiling below, core was drilled within a fraction of an inch of total depth using diamond drill bits. After water and cuttings were removed by vacuum, remaining thin shell was carefully knocked out

Photos courtesy Traco Masonry Drilling Div., The Wheel Trueing Tool Co.

Flame Failure System Switches



THREE LARGE BOILERS, with total rated input of 530 million Btu per hr, supply steam for district heating and power to U. S. Military Academy. Electric eye flame failure protection installations can be seen on boiler in foreground, directly on top of wind box. These are mounted at about 60 deg from each other. Flexible leads run from electric eyes to conduits on face of boiler. Flame safeguards at each burner consist of two pilot lights and pushbutton and solenoid valve

● A new flame failure protection system installed at the United States Military Academy is indicative of a trend toward the use of automatic systems to guard against flame failure. The design of this system was complicated because of the possibility of electric power failure which would cause the fires in the boilers to be extinguished and in turn shut down the plant. This precluded a flame failure protection system as usually installed and called for the design of a system which would not be affected by power failures but would still have all the protective features generally obtained from these systems.

Mr. Friedman is a graduate of Newark College of Engineering. He was active in various phases of the construction industry for eight years. For the past five years he has practiced as a consultant in mechanical and electrical engineering.

BY MELVIN H. FRIEDMAN
Melvin H. Friedman & Associates
Consulting Engineers

RELIANCE on operating personnel to protect against flame failure damage to large boilers is rapidly becoming outmoded by automatic detection devices. An example of this trend is evidenced by a new automatic flame failure protection system installed in the steam plant at the United States Military Academy, West Point, N. Y.

The plant, which supplies steam for both district heating and power, comprises three boilers, two having four burners and the third having six. Preheated No. 6 oil is pumped at pressures up to 450 psig to achieve a flow at each burner of 270 gph. The total input for the 14 burners is 530 million Btu per hr.

These boilers, originally coal fired, were converted to oil firing during World War II. Prior to the installation of the protection system the only insurance against flame failure damage was the vigilance of two operators on duty at all times on the firing floor.

Controls were installed with the conversion burners for modulating fuel flow to maintain steam pressure. Burners are ignited and extinguished manually to suit the load conditions, thus allowing complete flexibility.

Protect Against Power Failure

The boilers are normally operated with electrical auxiliaries. However, on power failure, changeover is made to steam auxiliaries without extinguishing the fires and before the steam head on the boilers is lost. The problem of electrical power failure has arisen subsequent to a cross-connection at the main plant power bus with a utility company whose lines are subject to voltage surges during

Boiler Auxiliaries to Steam Operation

. . . without extinguishing fire before steam head is lost

summer lightning storms which open the main breakers to the main bus.

Loss of both steam and electricity for the auxiliaries would shut down the plant entirely and the problem of restarting would be great. Fuel oil is steam preheated and pressure atomized, accentuating the problem of starting without steam.

Various systems were considered to achieve protection against power failure. Use of separate generators or a battery with recharging equipment was considered and would have been dependable, but these ideas were discarded because of expense both in first cost and maintenance.

One Scanner Per Burner

The flame failure protection system consists of a separate scanner for each burner which operates through a control panel to close the individual fuel valve, light its respective pilot, and sound an alarm upon flame failure at the burner.

Consideration was given to the fact that, should a particular burner be extinguished or have its torch improperly placed for lighting, fires in the adjacent burners would light the oil anyway and thereby prevent damage. This being the case, scanners could have been installed on every second or third burner instead of on each one to reduce the cost of the installation. However, it was decided to place a scanner on each burner in order to retain the desired flexibility.

Individual scanners allow any burner to be the first lighted on the boiler on startup and eliminate the necessity for a set sequence of burner lighting after startup. In other words, a burner without a scanner could not be lighted until an adjacent burner was operating.

Lead sulphide scanners that can discriminate between the steady radiation from the hot refractory and the oscillating radiation from the flame itself are used. Precautions are taken, however, to limit the total amount of radiant energy received by this cell to avoid false indications.

Adjust Cell Viewing Area

The photocells are installed in sections of $\frac{3}{4}$ in. pipe which are threaded to accommodate the various attachments. Each cell is located on the outer end of a pipe nipple. The area viewed by a cell is controlled by changing the pipe length inside the boiler and by inserting an orifice mounted in a coupling between the cell and the end of the pipe. The pipe is welded to the outer boiler wall, with its axis along a predetermined line of sight.

The line of sight of the cell intersects the flame axis at a point approximately 6 in. from the burner tip. This allows the flame to "float away" from the tip on high fire, but is close enough to monitor the flame on low fire. The line of sight was so chosen as to have the coolest part of the refractory as a background to decrease the total radiation "seen" by the cell.

Fuel valves are manually opened and spring closed, with a latch to hold the valves in the open position. The latch is engaged and released electrically. This valve arrangement allows manual ignition and keeps the operating fuel valves from closing on power failure.

How Equipment Operates

The equipment is operated as follows:

1) On light-off of the first burner of a boiler, the prepurge button on the boiler control cabinet is pressed.

2) After a predetermined prepurge interval, the pilot proving circuit is automatically energized.

3) A torch is ignited and inserted through a port in the wind box above the burner. When the torch is in the proper position the fuel valve holding circuit is energized.

4) The fuel valve is manually opened, igniting the burner, and is electrically latched open. If the fuel valve is opened prior to pilot proving, the alarm bell rings and the valve will not latch open.

5) On flame failure the valve for the particular burner closes, an alarm bell rings, and a pilot lamp lights at the burner.

6) On power failure, the burners are not affected. On those burning, the valves remain open. On those shutdown, the valves remain closed.

With the valves arranged as described, protection against power failure has been achieved. The only drawback to the system is the possibility that a fuel valve can be opened without its torch being in the proper position. This is normally guarded against by use of a valve with a tripfree handle, the handle being engaged electrically, allowing opening after the pilot has been proven. In this system, however, such protection was not obtainable — even with a battery plant — because it was not possible to find a valve with a tripfree handle that would operate at the 150 psig pumping pressure.

Grateful acknowledgement is made to John Peck, P.E., working under the supervision of Col. Thompson, post engineer, for invaluable assistance.

This project was undertaken as part of a comprehensive rehabilitation and maintenance program at the Acadamy. Architects for the job were George M. Schofield and John M. Colgan. Melvin H. Friedman & Associates were the consulting engineers. Contractor for installation of the control equipment was R. Herman Chesser & Son.

Corrective Water Treatment Prevents Scale Deposit, Corrosion

. . . *in water cooled air conditioning systems*

BY J. L. THORNLEY
Chief Chemist
Bird-Archer Co.

IN MODERN AIR CONDITIONING, water is utilized in a variety of applications, the three main ones being humidity control systems, chilled water systems, and condenser cooling systems. Unfortunately, water has properties that sometimes make its use objectionable. The principal adverse feature is its ability to dissolve materials from the air and soil through or over which it passes. These materials eventually deposit as scale or cause corrosion of metal parts of a water cooled system. Water is also the natural habitat of algae, protozoa, and other minute organisms which form slime and biological growths that can seriously affect the system operation by impeding heat transfer, restricting the water flow, and initiating and sustaining corrosion reactions. Conversely, water is a very efficient heat transfer medium, affording greater cooling efficiency than any other inexpensive substance.

• Water, while being an excellent heat transfer medium for air conditioning, has the objectionable property of being able to dissolve solids and eventually deposit them as scale in water cooled systems. This formation can impede heat transfer, restrict water flow, and cause and sustain corrosion. The author details these problems as they affect the three main types of water-using systems and tells how to prevent them through water treatment.

Mr. Thornley was graduated with a BS in chemistry from the University of Pennsylvania. As chief chemist for the Bird-Archer Co., he is primarily concerned with the development of treatment formulation and feeding systems for air conditioning cooling water. He also is an instructor in chemistry at Drexel Institute, Philadelphia.

Air Washers Subject to Precipitated Solids

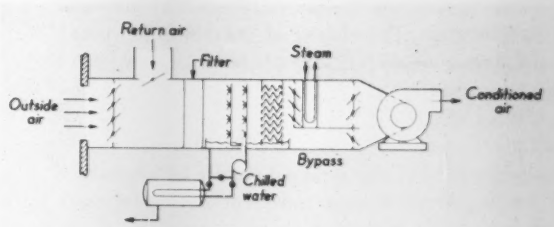
What are the specific difficulties encountered in the use of water in air conditioning? Let's discuss the three main applications, i.e., humidity control systems, chilled water systems, and condenser cooling systems:

The humidity control system in which an air washer is used consists essentially of a chamber wherein the air to be conditioned is brought into intimate contact with a dense spray of water. If heat is neither added to nor taken from the spray water, the air will then become saturated or partially saturated. Thus the unit functions as a humidifier. It can be made to function as a *de*humidifier if the spray water is chilled before or during spraying. Air washers also are capable of removing some of the solid impurities that become airborne. Dust and grit particles, for instance, become wetted with water and fall into the bottom reservoir by gravity.

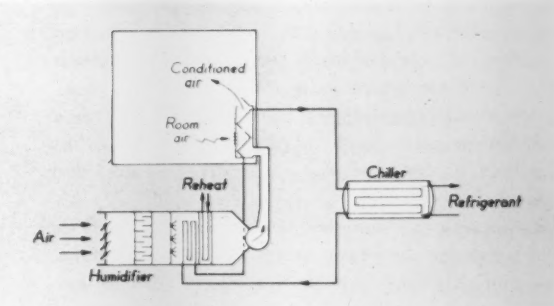
Air washers operating on a humidifying cycle are constantly evaporating water and drawing makeup water into the system. The dissolved solids which enter with the makeup water remain in the system and become concentrated. If this concentration is not controlled, precipitation can take place and scale can form in the recirculating lines and spray nozzles to restrict the flow of water and lower the efficiency of the unit. Control of concentration should be maintained by continuously bleeding a portion of the circulating water to waste and making up with fresh water. This is comparable to the continuous blowdown system used in boiler operation.

These 3 systems are main users of water in air conditioning

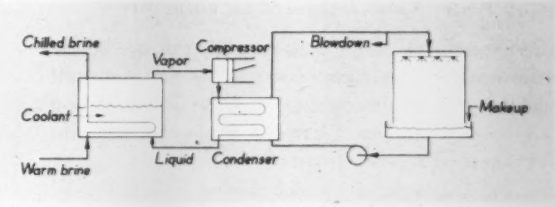
HUMIDITY CONTROL or air washer systems are subject to deposition of dissolved solids. Control of concentration should be maintained by continuously bleeding portion of circulating water to waste and making up with fresh water



CHILLED WATER systems operate with little or no makeup and only problem is corrosion which can be easily controlled by use of sodium chromate in range of 500 to 1000 ppm and maintaining pH of water at 6.8 to 7.5



CONDENSER-COMPRESSOR cooling water systems, which are either once-through or recirculating types, can be protected from corrosion and scale formation by use of proper inhibitors. Open recirculating systems face additional problems of biological growths and destruction of wooden parts by delignification, fungus rot, erosion



Other difficulties encountered in air washer operation are slime formation, corrosion of metal, carryover of solids from the water, and erosion of spray nozzle orifices. Slime is controlled by the use of chlorine, phenolic or quaternary ammonium compounds or other agents, and by periodic cleaning. Ordinarily, a weekly cleaning of nozzles and tank is sufficient. Depending on conditions, corrosion of metal is controlled by pH adjustment of the water and by the use of phosphates, chromates, or nitrites. Carryover is usually a function of design and entails the proper placing of eliminators which catch entrained drops of water. Erosion of spray nozzles is also a function of design and with some units periodic replacement of caps or of complete nozzles is required.

Air washers that function as dehumidifiers constantly take moisture from the air and continuously overflow to waste. Scale formation is not generally a problem here, but corrosion and slime formation can still occur. Slime control agents and corrosion inhibitors are used to combat these conditions. But an additional problem of maintaining treatment balances results, since the system continuously overflows some of the treatment to waste. Overflow is inconsistent, however, since atmospheric conditions can change its rate in only a matter of minutes.

Must Control Corrosion in Chilled Water Systems

Chilled water systems operate with little or no makeup and one of the main problems in a well operated system is that of corrosion. This may be controlled, however, by the use of sodium chromate in the range of 500 to 1000 ppm and by maintaining the pH of the water at 6.8 to 7.5. If pH values are carried too high, dezincification of brass parts of the system results; if pH values are too low, acidic corrosion occurs.

Condenser-compressor cooling water systems are of two

general types: once-through and open recirculating. Once-through systems are normally used where there is a plentiful supply of water since the water passes through the system only once and is then discharged to waste. Rivers, ponds, or wells are usually the source of supply.

Corrosion is also the chief difficulty encountered in these systems because the water used is generally saturated with oxygen. Polyphosphates or silicates are used to inhibit corrosion, the choice of inhibitor depending on the hardness, alkalinity, and pH value of the water and the temperatures existing in the system. Polyphosphates are fed at the rate of 2 to 10 ppm and silicates at 14 to 28 ppm.

Polyphosphates and silicates can usually be discharged into rivers or streams without objection since food grade materials are used in the treatments.

Scale formation is sometimes a problem in once-through systems, especially where the supply water is high in bicarbonate hardness. In this case, a very low concentration of polyphosphate (only 2 to 10 ppm) is used to hold the hardness salts in solution.

Open recirculating systems are normally used where a plentiful, inexpensive supply of water is not available. They include cooling towers, evaporative coolers, and spray ponds.

These systems are economical in the use of water, since only the water lost by evaporation plus a small amount lost by wind drift and blowdown needs to be made up.

Re-use of Water Causes Operating Difficulties

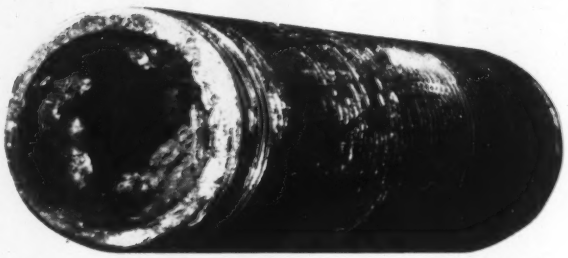
A water treatment program is necessary in the operation of an open recirculating system since the continued re-use of water leads to operating difficulties. Among these are scale deposition, corrosion, biological growths, and destruction of wooden parts.

Water contains impurities which deposit as scale in the system as the water evaporates. As mentioned previously, as fresh water is constantly added to a system to replace that lost by evaporation, more impurities enter the system and eventually concentrate to a point where their solubility is exceeded. They then deposit out as scale and seriously impede heat transfer and water flow. Calcium and magnesium salts are the principal scale forming agents, although corrosion products, precipitated iron salts, and organic matter frequently are found in scale deposits. An increase in temperature can also be responsible for scale deposition since soluble calcium bicarbonate becomes insoluble at higher temperatures.

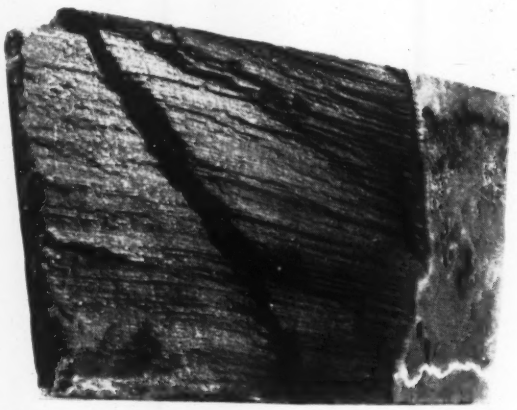
Deposition is prevented by limiting the cycles of concentration of solids in the water by a continuous blowdown system and by feeding sulfuric acid or other chemicals that convert the potentially scale forming solids to a more soluble form.

Maintain pH in Neutral Range

Corrosion of metal parts of recirculating systems occurs in the presence of water and oxygen and can lead to shutdown and costly replacement. Water of low pH value is more corrosive to iron and steel than water of neutral or high pH. However, high pH values in circulating water are objectionable because of other adverse effects they can cause—scale deposition, the rotting of wood, and corrosion of aluminum and brass. Therefore, pH is generally maintained in the neutral range of 6.5 to 7.5.



THIS SECTION of chilled water line shows buildup of corrosion products. Condition obstructs water flow, lowers efficiency of system



FUNGUS ORGANISMS feed on wood and cause it to rot, as is evidenced by this section of a redwood cooling tower. Pretreatment of tower lumber with copper compounds, phenolic materials, other fungicides has shown some benefit, but problem has not been solved completely

The pH value of makeup water may be naturally low; the pH value of the circulating water may be low due to the absorption of acidic gases from combustion or from process equipment. If it is necessary to raise this pH, it can be done by feeding caustic soda into the line. However, in the case of low pH makeup water, consideration should be given to changing the source of supply. In the case of absorption of acidic gases by the circulating water, consideration should be given to the relocation of the cooling tower to a more sheltered area or to elevating the gas-emitting stack.

Control of pH alone is not a sufficient corrosion preventive. Inhibitors must be used in most cases. These include chromates, phosphates, nitrites, zinc salts, and various combinations of chromates and phosphates or chromates, phosphates, and zinc salts.

Biological Growths Impede Operation

Biological growths (slime and algae) can accumulate in open recirculating systems, as can minute worms and other forms of aquatic life. They develop in the open part of the system and frequently are swept through by velocity of flow. They interfere with heat transfer, restrict flow of water by constricting pipes and orifices, and promote corrosion by forming a barrier between metal and corrosion inhibitors.

Biological organisms are controlled by feeding slimicides or algaecides to the circulating water. These include chlorine, chlorine releasing compounds, sodium pentachlorophenate, quaternary ammonium compounds, rosin amines, and other materials. They must be fed in controlled amounts since underfeeding will not accomplish the desired control action and overfeeding can result in harmful side effects—corrosion acceleration, wood deterioration, and foam formation.

Prevent Destruction of Wooden Parts

Cooling towers, being constructed either partly or entirely of redwood, cypress, or other durable wood, are subject to several forms of attack which can lower their efficiency and can even destroy them. These are delignification, fungus rot, and erosion.

What is *delignification?* Wood is composed of cellulose fibers held together largely by lignin, a binding material. Lignin is soluble in alkaline solution and can be leached out of wood by alkaline circulating water, leaving only the cellulose remaining. When this occurs, wood loses its strength and may be easily torn into splinters by water erosion. A delignified cooling tower, for example, may collapse just from the weight of water in it. The weakening effect of delignification can be shown by density values. New redwood has a density of 0.436 grams per ml; some delignified sections have densities of only 0.170 gram per ml.

Delignification is prevented by maintaining the pH value of the circulating water in the range 6.5 to 7.5. In many cases, this requires the feed of acid to the circulating water. Sulfuric acid is generally used because of its low cost. But other materials such as hydrochloric and citric acids and sodium bisulfate are sometimes used.

Fungus organisms feed on wood, causing it to rot. They thrive in the presence of oxygen and moisture. Some feed on wood cellulose, others on lignin. The resulting attack is hard to distinguish by visual examination from that due to alkaline water delignification. No completely satisfactory method for preventing fungus attack has been worked out yet, but pretreatment of cooling tower lumber with copper compounds, phenolic materials, and other fungicides has shown some benefit. In addition, weed killers have been applied to already operating towers to destroy fungus organisms.

Erosion is a form of attack produced by flowing or falling water. Small pieces of wood are eroded from the main section. The attack is intensified by suspended solids in the water. It can be minimized by improvement in design and by reducing the concentration of suspended solids either by blowdown or by the installation of a side stream filter. The latter involves bypassing a portion of the circulating water through a filter and then returning the filter effluent to the tower sump.

From this discussion, it is apparent that the efficient operation of any water-using air conditioning system requires a program of preventive maintenance. This program should include corrective water conditioning, visual inspections, and mechanical cleaning. ‡

Two 236 Ton Absorption Refrigeration Machines To Air Condition Research Center Throughout

. . . will use steam to produce chilled water

TWO ABSORPTION REFRIGERATION machines are being installed at the Gulf Research & Development Co. in Harmarville, Pa., as a major step in providing air conditioning for the entire research center, according to Carrier Corp.

The two absorption machines, of 236 ton cooling capacity each, will use steam to produce chilled water for air conditioning units installed in parts of five major laboratory buildings and several smaller structures.

A majority of the more than 1500 employees will work in a controlled climate when the air conditioning project is completed. Systems are being designed so that a high volume of exhaust air will carry off fumes generated in laboratory experiments with petroleum products.

The absorption machines will be placed in an underground vault and covered with landscaping. From this centrally located refrigerating plant, chilled water for cooling will be piped through subterranean passages, which are also used as all weather walkways by personnel. ‡

How to Design Refrigerant Piping

● Refrigerant piping systems are closed circuits which contain volatile fluids. As such, they are subject to the effects of mechanical, thermal, chemical, and variable pressure influences. In addition to the generally accepted good practices used in pressure piping design and installation, refrigerant piping systems demand special considerations. In the July issue the author discussed the choice of piping materials. Here, he describes the pipe joining techniques which should be followed to obtain the tightness and strength that are so vital to successful operation. These systems should always be designed according to the requirements of all applicable local codes and the Code for Pressure Piping, ASA B31.1.

Mr. Smith received his BS in mechanical engineering from Virginia Polytechnic Institute in 1949. After graduation he joined Worthington Corp., serving in its air conditioning and refrigeration research and development laboratory. He was awarded his masters degree in engineering at Stevens Institute in 1957. A licensed professional engineer in New Jersey, he is an instructor of special courses at Newark College of Engineering. For the past seven years he has been a product engineer in Worthington's central station engineering department.

BY W. C. SMITH
Product Engineer
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Worthington Corp.

THE TWO primary considerations in joining refrigeration piping are tightness and strength. Factors such as appearance, ease of assembly and disassembly, and cost will, of course, enter into specific design decision. But *in every single case* tightness against leaks and strength to hold the necessary pressure are considered first and foremost, because refrigerants can easily leak through joints that would ordinarily be watertight or airtight.

The actual cost of lost refrigerant is but a portion of the expense resulting from leaks. To repair a leak, the remaining refrigerant must be pumped from the system to storage. Before lighting a torch or striking a welding arc, the residual refrigerant in the section to be repaired should be purged with dry nitrogen. After the repair, the portion of the system which has been opened to atmosphere must be both pressure tested and completely evacuated. Then the system can be recharged, adding the lost quantity of refrigerant. All the while, special precautions are required to insure that no moisture or air is introduced into the system when the refrigerant is returned to it.

To prevent future operating troubles, these steps must be carried out without shortcuts. Therefore the cost associated with a leaking pipe joint is not complete until the value of lost refrigeration capacity for the time required to properly repair the leak is included.

For steel pipe 3 in. IPS and smaller, both welded and screwed joints are used. Screwed joints are most common in small ammonia lines. Ammonia leaks are less critical than most other refrigerants, largely due to the fact that ammonia is a relatively inexpensive refrigerant and its presence is obvious to the sense of smell. Moreover, its use is becoming confined primarily to industrial applications where an occasional whiff will not cause panic.

Welded joints are preferred, but are not always best for all applications due to their cost and permanency. For the more expensive halocarbon refrigerants, for all hydrocarbons, and for systems operating below atmospheric pressure, welding should be considered for all but the very smallest of lines.

A suitable threading compound that will withstand the

refrigerant in question must be used with threaded joints. Remember, many refrigerants are good solvents. Refrigerant gas also has a way of finding very small passages for escape. Make sure that the compound used will not only fill the voids in the threaded connection, but that it will not dissolve into a useless liquid on contact with the refrigerant.

Exposed threads are very susceptible to atmospheric corrosion. This is unfortunate since the root of the thread already represents the weakest part of the piping design. Thorough tinning of the threads will help to protect them from atmospheric corrosion and may also be beneficial in the forming of leaktight joints.

Brass and copper pipe are too malleable to provide good threaded joints. Although they can be initially made up tight, they can't be backed off for alignment. Also, if they must be disassembled, it is often necessary to make them up a complete turn tighter than previously. This is not unique to refrigerant piping; the disadvantage is more critical, however, since the development of leaks can be so expensive.

Fatigue failure at the root of a threaded pipe is much more prevalent with brass and copper than with steel. It is virtually impossible to eliminate *all* vibration from *every* joint in a system. So this hazard must not be overlooked.

Many refrigerant piping systems are subject to periodic increases and decreases in temperature (thermal cycling). If this is of sufficient magnitude and frequency, changing thermal stresses may loosen a threaded joint. Thus, threaded joints which might otherwise be perfectly sound have been known to come loose and develop leaks after some time in satisfactory service.

One common practice is to use threaded joints on refrigeration pressure vessels for convenience in the shop pressure testing and as an aid in the pipe erection in the field, but to seal weld them prior to pressure testing and charging the system with refrigerant.

The ASA Code for Pressure Piping, ASA B31.1, does not permit threaded refrigerant connections larger than 3 in. IPS below 250 psi design pressure nor larger than $1\frac{1}{4}$ in. above 250 psi.

The preferred method of joining steel pipe is by fusion welding. Quality welding is leakproof and permanent, with no weak points in the system. Great care must be taken in welding steel pipe to prevent slag and scale from entering the system. This one factor contributes to a very serious portion of compressor and control failures.

With the smaller piping, welding joint rings cannot be used as they would restrict flow. Here, socket fittings are best.

For 3 in. pipe and larger, flanged valves, vessel connections, and unions are common. A "confined gasket" type of flange facing is best. Special tongue and groove flanges, fittings, and valves have been developed specifically for refrigerant piping systems.

Although producing flanges of the same general type, each manufacturer originally had his own standards of facing and bolting dimensions. Incompatability can be avoided by purchasing equipment, valves, and fittings with the necessary companion flanges. Some difficulties might still exist where it might be desirable to bolt a valve of one standard directly to a vessel with flanged connections made by a different manufacturer.

There has been somewhat of a trend in recent years to standardize on one flange design. As a result, there is a considerable amount of interchangeability of many of the more common makes.

Sweat Fitting Is Most Common Joint

By sheer number of systems, there is no doubt that the most common refrigeration piping joint is the brazed or "sweat" fitting. Practically all halocarbon systems have some brazed joints. A good portion of them are exclusively brazed.

Silver braze material with a melting point above 1100 F is used. Extreme care should be taken in preparing and sweating the joint. Both tubing and fitting must be clean and accurately fit. Except in emergencies, it is foolish and expensive to attempt to salvage once used or deformed fittings. The cost of rework and of possibly having to locate and repair leaks might easily run hundreds of times the cost of a new fitting.

Brazed joints should be made up with complete penetration of the joint surfaces. Where it is at all possible, the insides of subassembly joints should be inspected after completion. A complete ring of silver showing at the joint will insure that full penetration has been achieved. Of course, it is impossible to inspect the interiors of all joints. Therefore the final connections should be planned in advance. They should consist only of simple joints which are most accessible for the man and torch. Couplings or elbow joints in vertical lines where the brazing is down-hand is an example.

Silver braze material is expensive; never use more than enough to just complete the joint penetration.

All pipe and tubing must be cleaned of surplus braz-

Observe These 10 Rules

1) Select materials compatible with refrigerants.
2) Specify proper design temperatures and pressures.
3) Consider all applicable codes.
4) Do everything possible to avoid refrigerant leaks.
5) Mating flanges must mate. Check to be sure.
6) Keep piping absolutely clean.
7) Use proper and sufficient supports.
8) Consider thermal contraction and associated stresses.
9) Consult qualified people for system design.
10) Apply sufficient insulation where required and seal completely against moisture penetration.

ing flux. Most fluxes can cause corrosion of the tubing at the joint. Flux remaining inside the system could account for refrigerant chemical breakdown.

Welding, brazing, or silver brazing on a system *containing* refrigerants should never be done. As previously mentioned, ammonia is, in some concentrations, as explosive as the hydrocarbons. The halocarbons may form toxic phosgene gas on contact with open flame. The portion of the system being repaired or modified must be evacuated of refrigerant and, for combustible types, purged with dry nitrogen as a minimum precaution prior to lighting the torch.

Flare joints and compression fittings of various designs are suitable for small refrigerant and instrumentation lines. The ASA Code limits their use to tubing $\frac{7}{8}$ in. OD and smaller. Unless there are no other requirements for brazing, and facilities and talent are not available, it would be good practice to eliminate all compression fittings in deference to brazing or at least to limit them to lines smaller than $1\frac{1}{2}$ in. OD.

How to Design Pipe Supports

Local codes often specify requirements for piping supports. ASA B31.1 contains a chart indicating maximum spacing. The ASRE Design Data Book suggests 40 pipe diameters minimum between hangers. The ASHRAE Guide gives equations for bending stress and deflection between supports.

Pipe hangers must support the weight of the pipe, its contents, and its insulation. Refrigeration lines are always pitched for drainage. (Gas lines always pitch downward in the direction of flow.) Spacing between hangers must be short enough, or the pitch steep enough, to prevent pitch reversals due to sags between supports.

Supports for vertical lines are designed to withstand vibration and thermal expansion effects. The supports or guides must prevent column buckling of long thin vertical lines and must relieve the weight on horizontal lines or equipment at the bottoms of these lines.

If supports cannot be fastened to structural members having sufficient mass to completely absorb and dampen transmitted vibration, they should be of a flexible non-transmitting design.

Building walls, ceilings, and floor slabs can serve as surprisingly excellent sounding boards—converting pipe transmitted vibrations into severe and bothersome noise. Case histories of noise and vibration transmitted through pipes, structures, and even the ground are fascinating only in the detective-like methods sometimes employed to locate the source.

Anchoring of refrigeration piping presents still another problem: On very small systems with rather light, flexible lines connecting relatively heavy and sturdy components, the equipment connections themselves serve as anchors. Sometimes the lines are so short that no intermediate supports are necessary.

Since provisions must generally be made for thermal expansion as well as support and vibration elimination, longer lines must be provided with some degree of flexibility. This might be accomplished by the use of a flexible connection, an expansion joint, or some direction changes.

Remember that a line which runs in three perpendicular directions, one normal to the plane defined by the other two, is much more flexible than one bending only in a single plane. The three direction lines can absorb expansion and contraction in torsion as well as in tension and simple bending.

Reciprocating compressors, when mounted on flexible vibration mounts, are usually fitted with flexible suction and discharge connections. These connectors serve the dual function of vibration and thermal stress isolation. They also compensate for some pipe misalignment. Obviously, the compressor connection cannot be expected to serve as a pipe support or anchor when such flexible lengths are used.

Larger Systems Require Expansion Joints

For the larger, less flexible piping which exists on centrifugal refrigeration systems, expansion joints are necessary. They not only compensate for the differential lengths, eliminating buildup of stresses in the pipe, but protect the compressor from being pushed out of alignment as well. Copper or stainless steel convoluted joints are common. Reinforced synthetic rubber joints are coming into practice. Expansion joints for refrigeration systems must be seamless. Slip joints are not permissible.

Anchoring long runs at their centers does not reduce the total amount of expansion or contraction, but does allow the piping at each end to take up one-half of the total. This is often the wisest thing to do, but be doubly cautioned to check both ends of the line.

A technique worth considering in particularly difficult cases is to prestress by deflecting the pipe in the direction opposite to its movement when stabilizing at operating temperature. This practice limits the stress and dimensions of the pipe to $\pm$ 50 percent of an unstressed condition rather than the zero to 100 percent experienced from erection in the unstrained condition.

Insulate Lines to Conserve Power

All low temperature refrigerant lines should be insulated to conserve power and to permit the equipment to furnish its full cooling capacity. Thickness of insulation is generally established as being that which will prevent condensation from occurring on the surface. Since the dewpoint will occur somewhere within the insulation, it is absolutely necessary that the external surface be completely sealed against humidity if the insulation is to be thermally effective and resist physical destruction.

Moisture laden insulation loses its insulating value. Alternate freezing and thawing of moisture in insulation will ultimately destroy it. Insulation manufacturers' data should be consulted for the recommended thicknesses to be used for various line sizes and differences in temperature. ≠

Controlling 100 Percent Outdoor Air Systems with Electronic Controls

• ***Good control is essential to the efficient operation of 100 percent outdoor makeup air systems. In this article are illustrated five such systems, along with a general description and operating sequence for each.***

BY C. JAMES BUSCH
Application Engineer
Barber-Colman Co.

In a ventilating system using exhaust fans, an adequate supply of makeup air is required to insure proper operation of the system. If makeup is not provided, a partial vacuum is created when the fans are in operation and the effectiveness of the ventilating system is greatly reduced.

Negative pressure also causes excessive infiltration around doors and windows, making it difficult to properly heat working areas. One hundred percent outdoor makeup air units correct these conditions by replacing exhausted air with filtered, preheated air.

A makeup air unit is not designed to heat a building. Its primary purpose is to temper outdoor air and supply it in sufficient quantities to eliminate negative pressure.

In effect, the entrance of unheated outdoor air substantially reduces a heating system's efficiency since most heating units are not designed to adequately cope with air infiltration when negative pressures exist. The 100 percent outdoor makeup air unit provides a systematic method of heating entering air and supplying it in appropriate amounts to meet exhaust requirements. With the proper balance of supply and exhaust, forced infiltration is eliminated and negative pressures are equalized.

Installation of these units does not appreciably increase boiler loading. Consequently, they do not add substantially to overall heating costs. This is understood when we consider that infiltrated air, warmed at least partially by the plant heating system, is ultimately mixed with room air and represents approximately the same heating load.

Engineers realize that good control design is essential to obtain the maximum results from makeup air systems. Exhaustive tests have proven that electronic proportional controls, where used, will fulfill this requirement. There are two reasons for this: the first is their rapid rate of response in sensing; the second is their use of a long, averaging duct element to insure an accurate sampling of the discharge temperature.

Discharge temperature controls should have outdoor compensation to offset the throttling range of the control instrument. Freeze protection is also recommended in the form of a thermostat wired to stop the fan if the coil surface temperature becomes abnormally low. Here again, a long element should be used. This thermostat should be designed to stop fan operation if any point along its length falls below its set point. Outdoor air control usually consists of a two-position operator which opens the outdoor air damper when the fan is running and closes it on fan shutdown.

There are some occasions when room temperature control may be used, but only in conjunction with a low limit thermostat in the fan discharge.

Control of 100 percent outdoor air units using steam or hot water as the heating medium are generally of the following types:

1) Units with one controlled heating coil

2) Units with two controlled heating coils

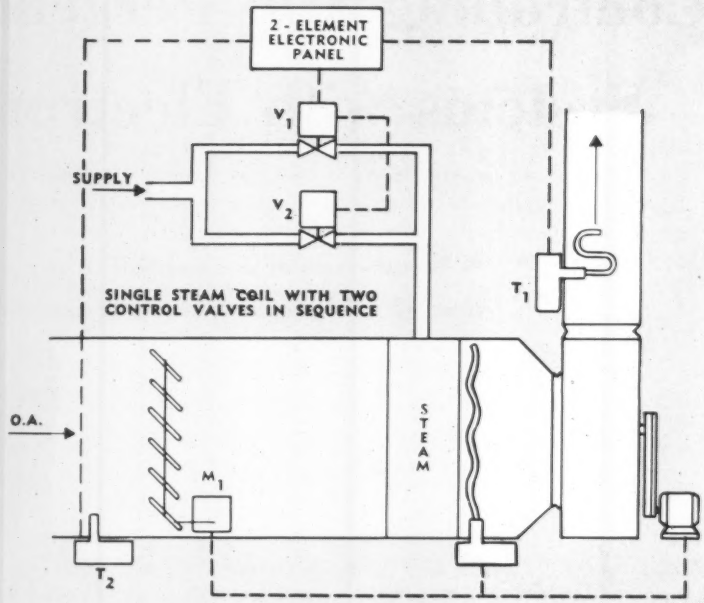
3) Units with a heating coil, face and bypass damper section, and various methods of control.

There are several systems having characteristics which are desirable in the control of 100 percent outdoor air systems. These are illustrated and described in Figs. 1 through 5 on pages 120, 121, and 122.

1—Single Steam Coil with Two Control Valves in Sequence

Description: Element T-1 in discharge, through electronic panel, positions motor operated valves V-1 and V-2 in sequence, with valve V-1 opening first on a call for heat. Element T-2 in outdoor air compensates discharge elements to raise control point as outdoor temperature lowers, or to offset effect of throttling range. Outdoor air damper is opened by motor M-1 when fan is running, and closed on fan shutdown. Thermostat in contact with coil surface stops fan if coil surface temperature falls below 35 F setting.

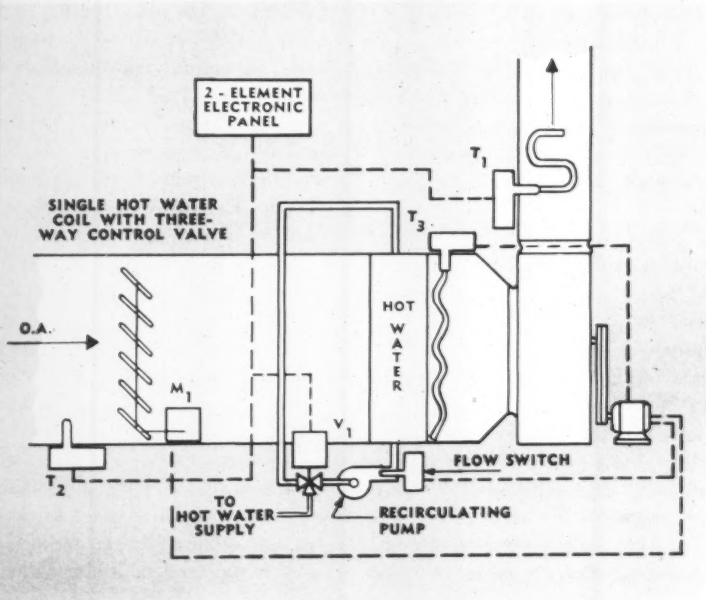
General design requirements: Valve V-1 should be sized to handle one-third of heating load. Valve V-2 should handle remainder of heating load. Improved control over single-valve system results in that valves are smaller, giving improved system turndown ratio. However, for best performance in both temperature control and freeze protection, system shown in Fig. 3 is recommended.



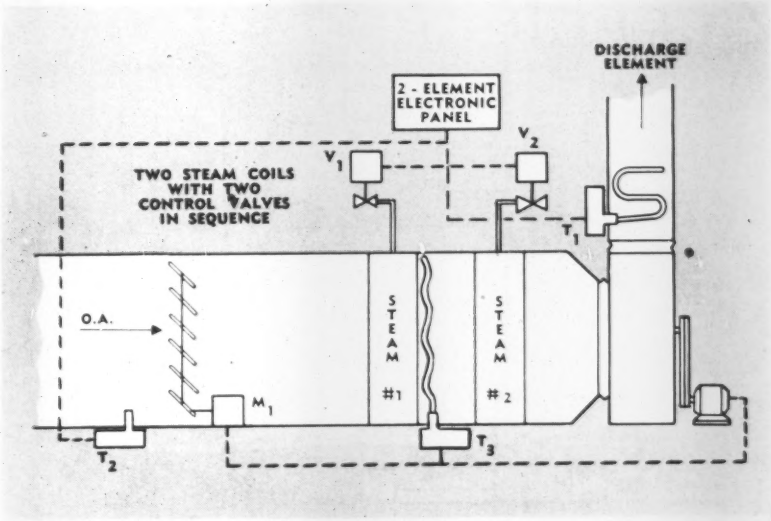
2—Single Hot Water Coil with Three-Way Control Valve

Description: Element T-1 in discharge, through electronic panel, positions three-way motor operated valve V-1 which mixes hot water and recirculated water to meet system requirements. Element T-2 in outdoor air duct compensates discharge element to raise control point as outdoor temperature lowers, or to offset effect of throttling range. Outdoor air damper is opened by motor M-1 when fan is running, and closed on fan shutdown. Thermostat T-3 in contact with coil surface stops fan if coil surface temperature falls below 35 F.

General design requirements: This system is reasonably freezeproof, since, to heat air to 70 F, water must be at least 70 F. Also, water in motion retards freezing. Outdoor reset on hot water supply is advantageous and should be used wherever possible. Flow control switch should be used to stop fan, should pump fail mechanically.



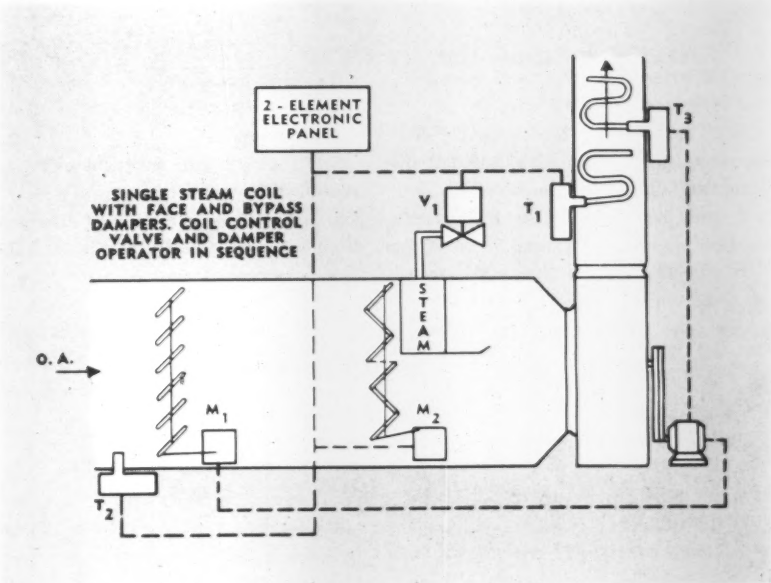
3—Two Steam Coils with Two Control Valves in Sequence



Description: Element T-1 in discharge, through electronic panel, positions motor operated valves V-1 and V-2, in sequence, with V-1 opening first on a call for heat. T-2 in outdoor air duct compensates discharge element to raise control point as outdoor temperature lowers, or to offset effect of throttling range. Outdoor air damper is opened by motor M-1 when fan is running and closed on fan shutdown. Thermostat T-3 in contact with coil surface stops fan if coil surface temperature falls below 35 F setting.

General design requirements: No. 1 coil should be sized for rise from 35 F to final temperature. No. 2 coil should be sized for rise from design temperature to 35 F. This assures that coil handling coldest air will be full of steam below 35 F. Improved control results in that valves are smaller, giving improved system turndown ratio. Multiple coils afford maximum freeze protection.

4—Single Steam Coil with Face and Bypass Dampers; Coil Control Valve and Damper Operator in Sequence



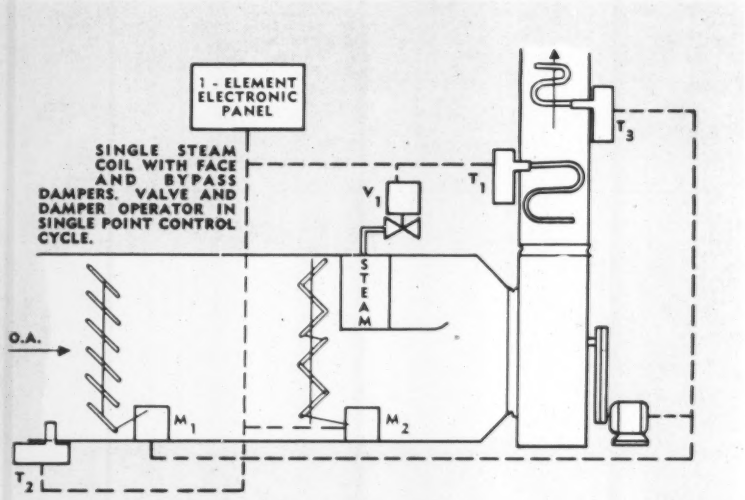
Description: Element T-1 in discharge, through electronic panel, positions motor operated valve V-1 and control motor M-2 in sequence, with valve V-1 opening first on a call for heat. Element T-2 in outdoor air duct compensates discharge elements to raise control point as outdoor air temperature lowers, or to offset effect of throttling range. Outdoor air damper is opened by motor M-1 when fan is running and closed on fan shutdown. Thermostat T-3 in contact with coil surface stops fan if coil surface temperature falls below 35 F.

General design requirements: Face and bypass damper must be linked so that some air (about 10 percent) passes through coil when damper is in bypass position. This system has slight tendency to cycle in mild weather, as valve must be large enough to pass all of the steam with all air over the coil at design outside temperatures. In mild weather, with small quantity of air over coil, valve does not reduce flow of steam until valve disc nears seat. High turndown ratio valves with equal percentage plugs help this condition. Is reasonably freezeproof, as valve is usually wide open at 35 F outdoor temperature.

5—Single Steam Coil with Face and Bypass Dampers; Valve, Damper Operator in Single-Point Control Cycle

Description: Element T-1 in discharge through electronic panel positions control motor M-2 on face and bypass dampers and valve V-1 in the following sequence:

On a call for heat, motor M-2 proportions face damper open. When face damper is wide open, control is transferred to valve V-1, which starts to open. When discharge air reaches desired temperature, valve V-1 stops and control is returned to motor M-2, which proportions face and bypass dampers to maintain this temperature. On a call for less heat, motor M-2 proportions face damper closed. When face damper is fully closed, control is again transferred to valve V-1, which then closes. Thermostat T-2 opens valve V-1 wide when outdoor air temperatures drop below 35 F. Outdoor air damper is opened by motor M-1 when fan is running, and closed on fan shutdown. Thermostat T-3 in contact with coil surface stops fan if coil surface temperature falls below 35 F.



General design requirements: Throttling range of control on motor M-2 is low, as it is a vernier. Outdoor reset is not applicable, as position of motor M-2 is not a function of outdoor temperature. Valve V-1 should be adjustable speed; then, if motor M-2 cycles through a full stroke, valve V-1 may be slowed down to eliminate cycling. Single-point control is applicable only if a discharge element is used. Never control from a room thermostat only, as valve V-1 will travel too far before room thermostat senses a temperature change. Use of an electronic room and discharge element is satisfactory. ‡

Set Standard Ratings for Electronic Air Cleaners

In order to standardize terminology and establish "certified ratings" for electronic air cleaners, the Air Filter Institute has approved a number of recommendations of its Electronic Air Cleaner Technical Subcommittee. These are:

1) That the name of the testing method be defined as "The National Bureau of Standards Dust Spot Method." The method uses atmospheric air without the addition of other dust or contaminant.

2) That the identifying term of "Electronic Air Cleaner" be used by all members of the Air Filter Institute in their literature.

3) That efficiencies of 85, 90, and 95 percent will be cataloged.

4) That capacity tables be based on efficiencies of 85, 90, and 95 percent, expressed in cfm, and rounded out to the nearest 10.

5) That the cell face area be defined as the gross area calculated from the outside dimensions of the cell and expressed in sq ft carried to three significant figures.

6) That the term "velocity" may be used in catalogs although it is not necessary since cell capacity in cfm for a given efficiency is basic. If used, "velocity" shall be defined as a calculated value in fpm equal to the capacity of the unit in cfm divided by the cell face area of the unit in sq ft carried to three significant figures.

7) That efficiency curves may be used in catalogs provided that velocity and or area values are defined in accordance with items 5 and 6.

8) That no claims will be made for collecting particles smaller than 0.01 microns.

9) That catalog data include the overall dimensions of the unit or system, since these are usually different from the sum of all the cells and include framework and or housing.

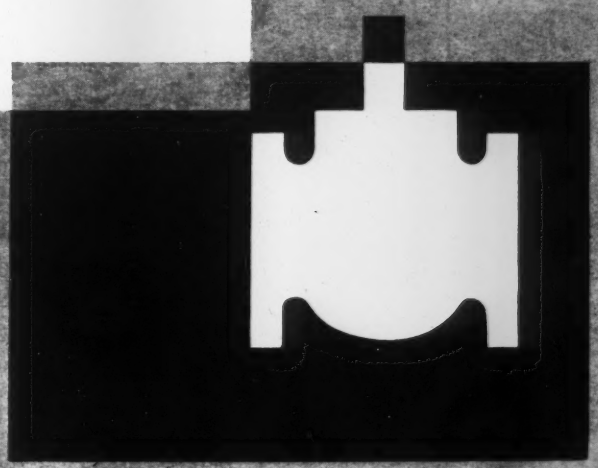
10) That an "AFI Certification of Ratings" be based on a well defined testing procedure established by a test code committee and using the Dust Spot Method.

11) That a "Standards Committee" be established to supervise tests, maintain records of tests, approve laboratories for certified testing, make recommendations in issuance or "Certification Seals," and to receive and investigate inquiries regarding accuracy of any certified ratings. ‡

HPAC ENGINEERING DATA FILE

What to Consider When Selecting Cocks and Plug Valves

- *Where are they used?*
- *What are basic designs?*
- *What port arrangement?*
- *What operating means?*



When selecting cocks, and especially when selecting plug valves, the same general considerations applicable to other types of valves must be taken into account. Such factors as service pressure and temperature, type of fluid handled, type of material required, (steel, semi-steel, or special metals), end connection, and operating means must be considered. Other considerations applicable only to cocks and plug valves include the port arrangement, and the shape and area of the plug port and body throats. The way in which cocks and plug valves are designed to satisfy these various considerations are discussed in this report.

Cocks and plug valves have certain characteristics that make them desirable in many piping applications. Two of these are low headroom requirements and rapid operation. Cocks differ from plug valves in a number of respects. The principal differences, which are evident from their designs, are the means of obtaining leak-free joints between the body and plug, and the method of achieving tight shutoff. Other characteristics of lubricated and non-lubricated plug valves, such as those which minimize binding of the plug, permit them to be used at pressures and temperatures much higher than those at which cocks will perform satisfactorily. These characteristics and applications of the various types of cocks and plug valves are presented in the report.

Carl A. Dopp, the author of two previous HPAC Engineering Data Files on the selection of valves, has contributed the information in this report on the subjects of cocks and lubricated plug valves. Mr. Dopp — who is a member of HPAC's board of consulting and contributing editors — has assembled this information from many sources. Likewise, the information on non-lubricated plug valves has been assembled from many sources. In both cases, consulting engineers who are designing piping systems, mechanical contractors who are installing these systems, and plant engineers who operate and maintain these systems were interviewed. Their opinions and comments were considered in the preparation of this report.

Consider These Factors When Selecting Cocks and Plug Valves

COCKS — AND PLUG VALVES, which have evolved from the cock — are made in a number of different designs, the differences being mainly in the shape of the plug and the means by which tight shutoff and leak-free joints between the body and operating members are obtained. It should be realized that plug valves have many characteristics that are not available in cocks. These permit the use of plug valves at much higher pressures and temperatures than those at which cocks will perform satisfactorily.

In the cock, tight shut-off and freedom from leakage between the body and the operating member both depend upon the accuracy of the fit between these parts. Contact of body and plug is sometimes maintained by spring loading the plug. The light coating of lubricant used on cocks to make operation easier will help maintain a tight seal.

Both the non-lubricated and lubricated plug valves use auxiliary means to prevent leakage to the atmosphere. Diaphragms, gaskets, and packing of various types are employed for this purpose.

Tight shut-off and ease of operation of non-lubricated plug valves are obtained in a number of ways which are discussed in more detail in later sections. The lubricant, which is applied while the valve is in service, is important in operation of the lubricated plug valve. These valves are also discussed in detail in later sections.

This report considers the selection of the general types of cocks, and both lubricated and non-lubricated plug valves. Some of the factors that must be considered when selecting these valves include the following:

1) The working conditions, including the range of operating pressure and temperature.

2) The fluid to be handled, and whether any unusual condition of corrosion, shock, or abrasion is likely to be present.

3) The material preferred, whether steel, semi-steel, brass, or other metal.

4) The type of end connection, and the type of facing if flanged.

5) The type of plug and throat ports, whether regular, round, or venturi, when different designs are available. These may affect pressure drop and face-to-face dimensions.

6) Whether a straight-way, three-way, or four-way pattern is required.

7) What operating means should be used. Wrench, gear, electric, and cylinder operation are available for plug valves.

8) The special features required, including provision for remote operation, underground installation, locking, etc.

Features of Cocks

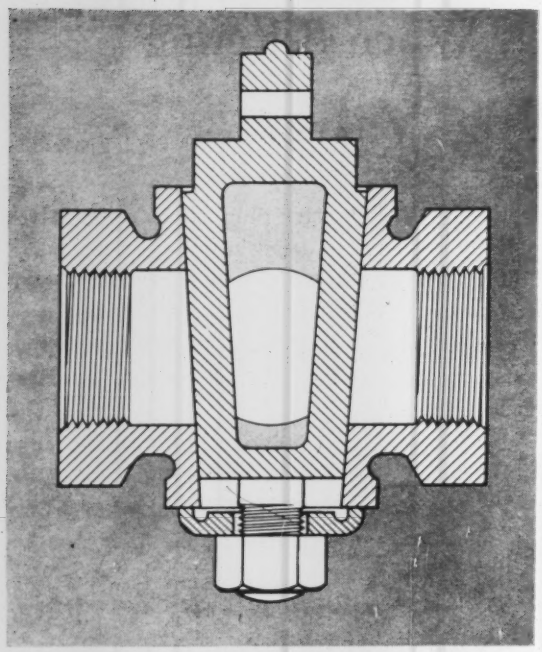
The first valves known to man were made similar in design to the cock. They were apparently used as early as 25 BC.

Where Are They Used?

Cocks are generally lower in cost than most other valves because they are less complicated to manufacture. Because of their low cost, simplicity, and speed of operation they are extensively used.

Cocks are used for water, oil, air and gas service. They should not be used for steam or other high temperature services. The heat will dissipate the lubricant and cause the plug to bind, resulting in galling of the metal. In addition, the plug will be at a higher temperature than the body, and will expand more. This difference in expansion will increase the binding. Possible leakage between the plug and body also makes the cock undesirable for steam.

Cocks are regularly made of brass or bronze, and iron. The plug in an iron cock may be either brass or iron. For some special applications they can be made of other materials.



1 STRAIGHT-WAY PLUG COCK of simple design is illustrated here in the closed position. Cocks are used primarily for water, oil, gas, and air service. Because of simplicity and speed of operation, they are often used. Binding of the plug at high temperatures due to difference in expansion of body and plug makes them unsuitable for steam. Freedom from leakage depends upon accuracy of fit between body and plug. Lubrication of the plug is essential for ease of operation

What Is the Basic Design?

The design consists of a tapered conical plug for rotation in a corresponding surface inside of the body, and means for turning the plug. Various methods for retaining the plug in the body are used, the most common being a washer and retaining nut, which is illustrated in Fig. 1. To avoid the danger of binding the plug, particularly in small sizes, many cocks are provided with a spring between the plug and the retaining nut.

The amount of leakage around the plug to the atmosphere depends upon the fit of the plug in the body seats. If this fit is not accurately made, leakage can be a problem.

Some cocks are made with inverted plugs—the large end of the plug is at the bottom instead of at the top. In such cases, the plug is held in place with a spring covered by a cap, closing the lower end of the body.

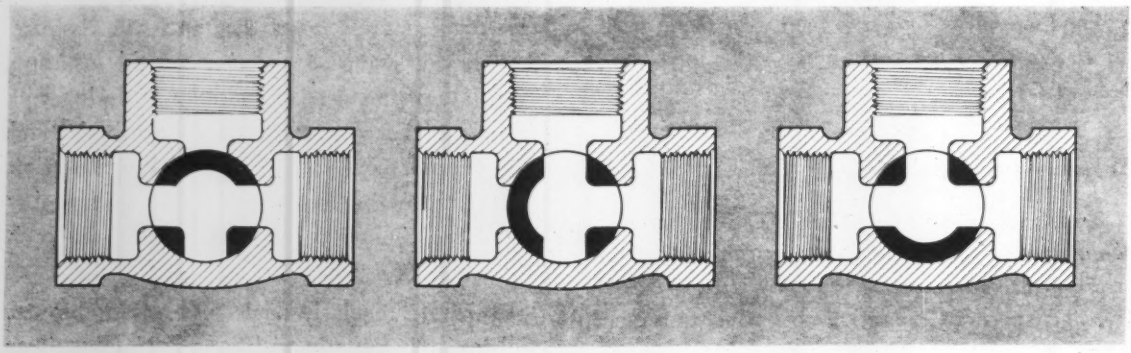
The body is provided with frustrum shaped conical ports, which when open coincide with similar ports passing through the plug.

Three Distinct Types

Cocks are made in three distinct types to meet the demands of a particular service. The *straight-way* shown in Fig. 1 is sometimes referred to as a stop-cock because its only function is to perform as a stop valve.

Three-way cocks are used for transferring the flow from one line to another, at right angles. They are regularly made with "tee" shaped ports (Fig. 2) in the plug. Three-way cocks are sometimes made with an "ell" shaped port (Fig. 3) through the plug for special application.

The *four-way cock* has four ports (throats) in the body. The plug has two "ell" shaped ports as shown in Fig. 4. In one position of the plug, the supply "A" is connected to the throat "B" and the throat "D" is connected to the discharge "C". By rotating the plug a quarter turn, the supply and discharge ports are reversed with reference to throats "B" and "D". These valves are often used



2 THREE-WAY COCKS are used for transferring flow from one line to another. Three of four possible variations in flow through cocks with "tee" shaped ports are illustrated here. Fourth position is similar to that in center except flow is diverted from "tee" to other straight through branch

to divert the flow from one side of a piston to the other, and at the same time to discharge the fluid from the downstream side of the piston. Fig. 4 illustrates such an application. A quarter turn of the plug reverses the direction of piston travel.

Three-way and four-way cocks are economical for transfer or diverting service within their pressure and temperature limitations.

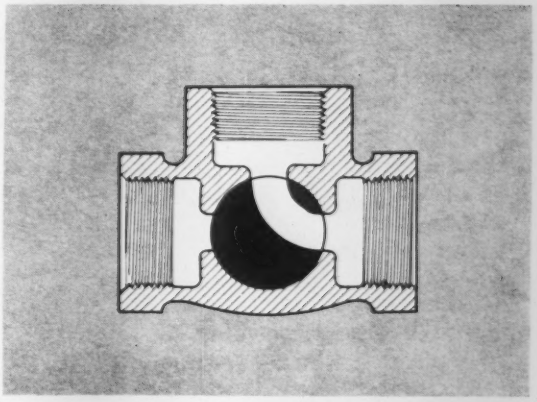
How Are They Operated?

Most cocks are made with a square or rectangular operating head integral with the top of the plug. Some, especially small sizes, are made with a "tee" head or with a lever integral with the plug.

Special wrenches to fit the square or rectangular heads are available. Any proper fitting wrench can be used. The straight-way and four-way cocks require only one quarter turn to operate. The rotation required for operation of a three-way cock depends upon the variation in flow divergence desired.

The position of the plug ports can be determined by the markings on top of a square head plug (Fig. 5). Rectangular and tee heads, and integral levers are made parallel to the port in the plug of a straight-way cock.

To be sure that the ports in the plug and body coincide, many cocks are provided with stops or checks to limit the turn (Fig. 5). These are lugs cast on top of the body against which a pin projecting from the plug is retarded. The location of the checks for three-way cocks depends upon the variation in flow divergence desired.

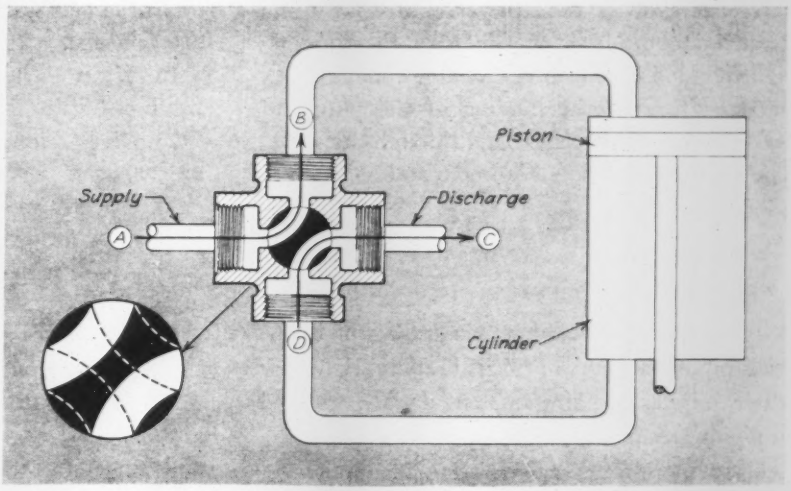


3 THREE-WAY COCKS with "ell" shaped ports as shown above are sometimes used in special applications. Flow can be diverted from "tee" to either straight through branch

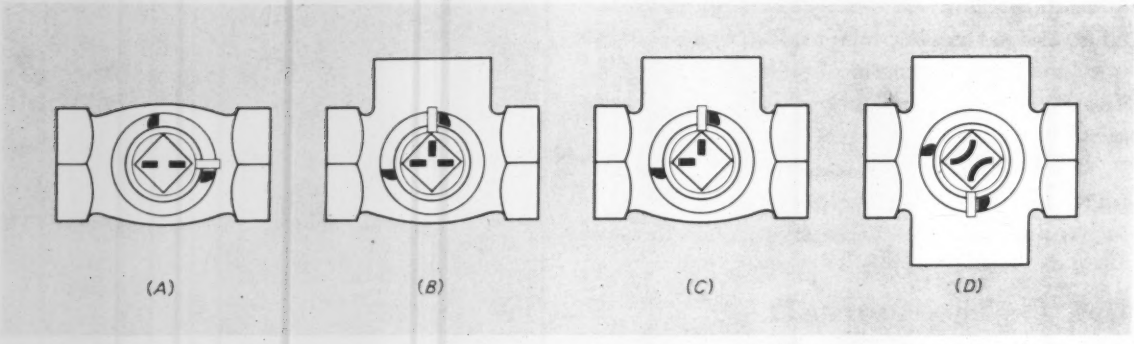
In any case, specifications should state whether or not checks are required. If required for three-way cocks, a sketch should be supplied indicating the various transfers to be made in service. When in doubt, a three-way cock without checks should be used.

Lubrication Is Needed

There is a relatively large contact surface between the plug and body seats in a cock. For this reason, these surfaces must be lubricated. Grease should be used for this purpose because it lasts longer than oil. Without lubrication, the surfaces will bind and make operation of the cock difficult, if not impossible. Frequent operation will gradually dissipate the lubricant. When a cock be-



4 FOUR-WAY COCKS are also used for transfer or diverting service. In common application shown here, four-way cock is used to control movement of a piston in a cylinder. The cylinder may be used to operate a valve, a damper, or other control device. In position shown, piston travel is downward. Dash lines in inset show alternate position of plug which connects supply and discharge ports to opposite ends of cylinder. When plug is rotated 90 deg to this position, piston travel is reversed



5 MARKINGS on top of square head cocks indicate position of ports in plug. Shown above are markings on: (A) straight-way cocks, (B) three-way cocks with "tee" shaped ports, (C) three-way cocks with "ell" shaped ports, and (D) four-way cocks. Each of these are shown equipped with checks that limit rotation of the plug and insure that the body and plug ports are properly aligned. Checks are lugs cast on top of the body and are shown in black here. A pin projecting from the plug is retarded by the checks

comes difficult to operate, it should be disassembled and lubricated.

Many Patterns Are Available

Cocks are used for many services and most manufacturers make a large variety. The most satisfactory way to select the proper type is by referring to the manufacturer's literature. In addition to those already mentioned, the following are a few examples of cocks for special service.

Hydrant stops (Fig. 6) are made especially for underground service. They have an "ell" shaped outlet. They are provided with a drain that opens when the cock is shut off. The purpose is to drain the outlet pipe and hydrant.

Pet cocks are used for checking the water line in a tank or boiler.

Corporation stops (Fig. 7) are used principally underground for connecting branch outlets to main lines while the latter are in service. They are designed to be installed with a special machine. This machine makes it possible to install the stop without shutting off the main line. Drilling, tapping, and installation are done under pressure in a special chamber within the machine. These stops are made in several different designs but are all made to fit the tapping machines.

Lock-up cocks are generally made to lock with a padlock in the closed position. They are also made for locking in either the open or closed position.

Non-Lubricated Plug Valves

As mentioned earlier, the non-lubricated plug valve has evolved from the simple cock. While maintaining the basic principles of the cock design, non-lubricated valves include modifications intended to minimize binding of the plug and leakage to the atmosphere and through the valve. The advantages of low headroom and quick operation are retained.

Used in Many Services

These valves are used in many different industrial piping services. Principal applications are water, oil, gas and air, but some designs are used in piping steam, slurries, and viscous liquids.

More specifically, the variation in application is illustrated by the following services for which they have been used in the practices of a number of engineers:

1) Water — temperatures from 40 to 450 F and pressures to 600 psig.

2) Oil — temperatures to 1000 F and pressures to 1200 psig.

3) Gas — temperatures to 900 F and pressures from a few inches of water gage to 600 psig.

4) Air — temperatures to 120 F and pressures to 250 psig.

5) Steam — maximum pressures of 250 psig.

The use of non-lubricated valves is not limited to the range of service conditions listed here. Some are made for working pressures above 3000 psig and temperatures to 1100F.

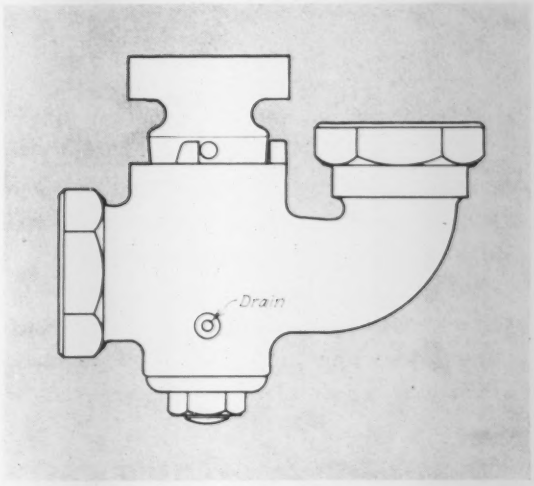
The range of temperatures and pressures for service with water indicate the use of these valves in piping systems for heating and air conditioning. They are being employed in chilled water lines, condenser water piping, and in hot water lines, including HTHW piping. In some cases, they are used for balancing or throttling valves. Most often they are used as stop valves. They are sometimes used in steam piping, but this application appears to be limited.

Many Variations in Design

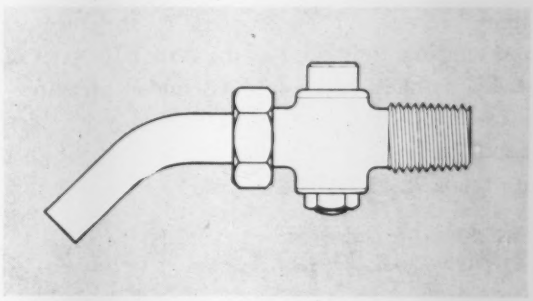
Several design variations are used to minimize binding and galling of the seating surfaces of non-lubricated plug valves. These reduce operating torque and the danger of the valve becoming inoperable. In some with conical or eccentric shaped plugs, the first movement of the operator lifts the plug slightly from the seat. Further movement of the stem rotates the plug and reseats it in the conical plug types or moves it to one side of the stream in the eccentric plug types. In other designs, body or plug seats are made of suitable plastics with low coefficients of friction, or the valves are provided with floating body seats. In these designs, the seats are self-cleaning and self-protecting. When the plug is lifted from the body seats, the seating surfaces are exposed to line fluid either during operation of the valve or while it is in the open position.

The plugs in non-lubricated valves are made in many shapes. Cylindrical, spherical, and conical plugs are used. The opening in the plugs may vary from full pipe area to approximately one-half of the pipe area. The pressure drop is somewhat greater in reduced port valves, but full opening valves have larger overall dimensions and, therefore, are usually more expensive.

Non-lubricated plug valves are regularly made in the straight-way pattern and are basically stop valves. However, some designs are available with multiple ports for transfer or diverting service. Tight shut-off is obtained by a number of different methods. Some of these are: the wedging action of tapered plugs in tight fitting body seats, coating the plug with resilient materials, and the use of seats made of plastic materials. The range of service pressures and temperatures for which these valves are suitable depends upon the seating material employed. Some conform to ASA B16.5



6 HYDRANT COCK shown here is one of many special patterns available. They are made for underground service. Drain in body opens when cock is closed to drain the riser pipe and hydrant



7 CORPORATION COCK above is another special pattern. It is used to connect branch outlets to mains without interrupting service. Principal application is in underground piping. They are installed with a special "tapping" machine. All installation operations are carried out with the cock and necessary tools enclosed in a pressurized chamber within the machine

pressure and temperature ratings. Manufacturers' recommendations should always be followed regarding working pressures and temperatures.

They are regularly made in steel and semi-steel. They are also available in many corrosion resistant alloys, stainless steel, aluminum, and brass or bronze. Others are lined with corrosion resistant plastics for special applications.

The plugs and body seats in some designs can be coated with corrosion resistant metals having low coefficients of friction to satisfy severe service conditions. This provides protection from corrosion and freedom from binding.

They are made with both screwed and flanged ends. The range of sizes available varies appreci-

ably for the different designs. Some are available in sizes from ½ to 20 in.

Many non-lubricated valves with flanged ends have face-to-face dimensions that conform to ASA B 16.10. They are made to replace gate valves where conditions make this possible. Other standards are conformed to whenever the materials used make this possible.

Stem leakage is generally prevented by the use of conventional packing glands. In some cases plastic packing rings are used. The packing material is selected to withstand the pressures, temperatures, and service conditions imposed upon it. Care should be taken to replace the packing with the same material when it becomes necessary.

How They Are Operated

They are regularly made to operate with a wrench or hand wheel. Geared operators are also available for convenience in operation. Cylinder and electric operators are available for many designs for remote or automatic operation. In most straight-way designs, one quarter turn will operate the valve.

Lubricated Plug Valves

Lubricated plug valves are made in various designs and materials to meet the many piping service demands. They are particularly applicable to refining, gas, chemical process, and oil field piping services. They conform to the pressure and temperature ratings of the ASA B16 series of standards. Lubricant—injected under pressure—is used to obtain tight closure and ease of operation. The low headroom requirements of the cock are retained.

Application Depends on Lubricant

Lubricated plug valves are used in many services. The major limitation to application is the availability of a lubricant that will withstand the service conditions. They are commonly used for water, oil, and gas service. Lubricants are also available for steam, and many corrosive fluids and slurries. It is mandatory that the proper lubricant be used in every case.

In heating and air conditioning piping systems, they are used in chilled water, condenser water, and hot water lines, including HTHW lines. They are also employed to a limited extent in steam lines.

Three Basic Designs

Three distinctive plug designs are presently used in lubricated valves. In two, the plug is of conical shape; in the third the plug is cylindrical in form. These are shown in Figs. 8 and 9. All types are opened and closed by rotation only, and not by raising and lowering the operating parts, so the seating surfaces are self-protecting and self-cleaning.

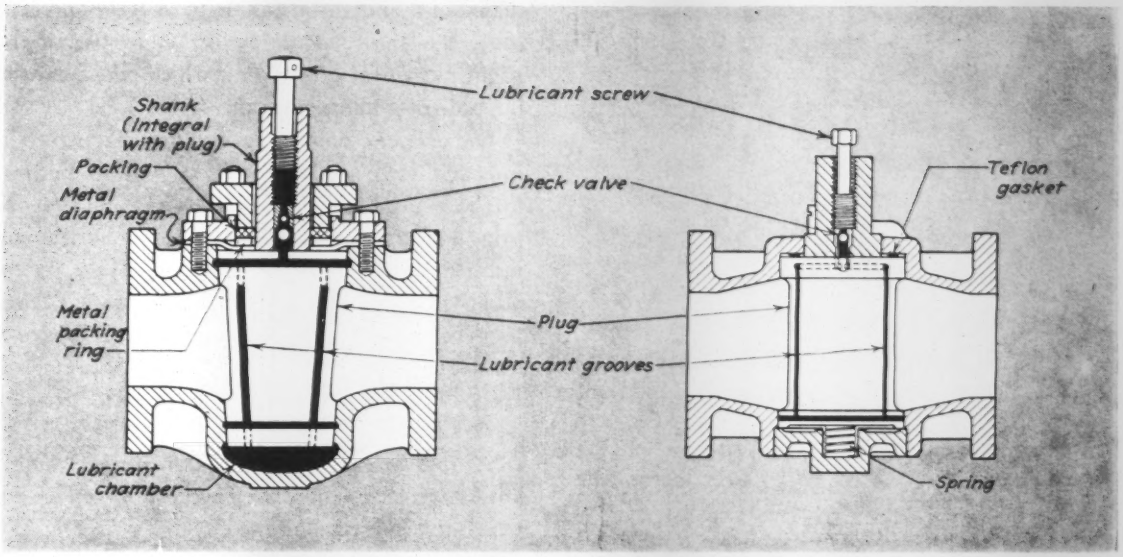
A most important feature in any lubricated plug valve is the provision for applying the lubricant. The valves are provided with either a lubricant screw or a grease fitting in the top of the shank or stem for feeding the lubricant into the valve. By turning the screw with a wrench or applying lubricant through the grease fitting with a gun, the lubricant is injected and travels down the vertical grooves and around the lower annular groove in the plug. These grooves are shown in Figs. 8 and 9.

Ball check valves are provided to prevent any back flow of the lubricant when the screw is removed. The vertical lubricant sealing grooves are located on opposite sides of the plug and 90 degrees apart. Consequently, they are not exposed to line fluid when the valve is in the full open or closed position. Lubricant should never be applied except when the valve is in the full open or closed positions. This recommendation is made to prevent dissipating lubricant into the line and to insure complete distribution of the lubricant.

Two Patterns With Conical Plugs

The conical shaped plug is used in valves of two different designs. The standard type shown in Fig. 8 employs a plug with integral stem. The small diameter of the plug is at the bottom of the valve. The other type, shown in Fig. 9, utilizes an inverted, full floating plug with the small end at the top.

They are regularly made in steel and semi-steel.



8 LUBRICATED PLUG VALVES are made in three distinctive designs. Two of the designs are shown here. The valve on the left has a conical shaped plug, that on the right has a cylindrical plug. The lubricant, which is applied mechanically by means of the lubricant screw shown or through a grease fitting with hand guns and pumps, is important in the operation of these valves. A light film of lubricant is forced onto the body and plug seating surfaces through the lubricant grooves when the valve is lubricated. Lubricants are available for a wide variety of services. Periodic and proper lubrication is necessary to prevent binding and leakage

Some patterns are available in stainless steel and many ferrous and non-ferrous alloys for corrosive services.

When lubricant is injected in the tapered plug types, a high pressure is developed in the chamber at the small end of the plug and in the sealing grooves. A *jacking action* is produced which momentarily unseats the plug and creates space for a thin lubricant film between the body and plug seating surfaces. This unseating occurs only when lubricant is being forced in. The jacking action combined with complete distribution of the lubricant overcomes adhesion and keeps the plug in free working condition, flushes the seats clean, maintains a positive seal, and protects the working surfaces from wear and corrosion. When the valves are lubricated with hand guns or pumps, a pressure gage is used to determine when the valve is fully lubricated.

For high temperatures up to 1000 F, both the body and plug seats are coated with special hard facing metal. At least one of the tapered surfaces (usually the plug) is coated with an extremely hard, non-galling alloy with a very low coefficient of friction. This hard surface is also highly resistant to most types of corrosion.

Stainless steel and other soft metals subject to galling are protected by hard coating the plug or both the plug and body seating surfaces.

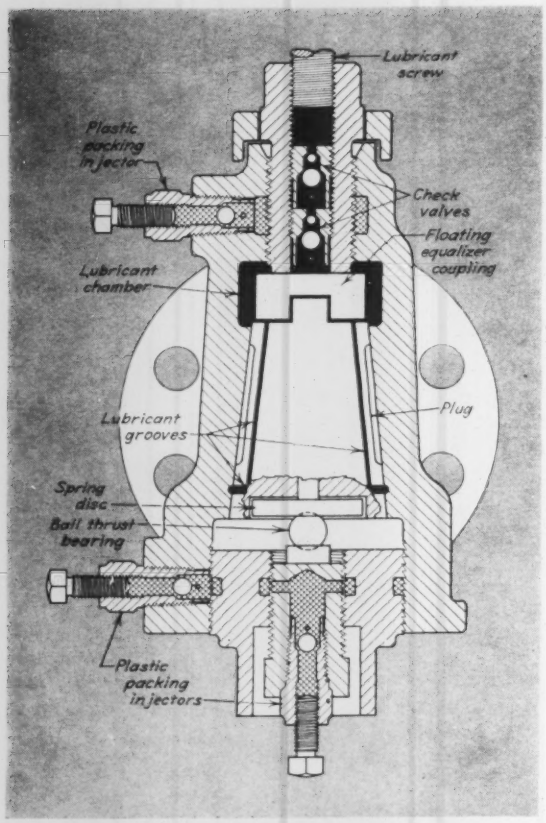
Standard Conical Plug Valves

Standard type valves are primarily for industrial service. Sizes 1 in. and larger are available with flanged ends. Screwed ends are available in sizes 4 in. and smaller. They are made in sizes ranging from ¼ to 36 in.

In the standard valves, the resilient packing prevents leakage around the shank. Large sizes have bolted glands while smaller sizes have a screwed type gland. Leakage from the top of the valve is prevented by the flexible metal diaphragm, which also acts as a gasket between the body and cover plate.

Inverted Conical Plug Valves

In the inverted plug design, the stem is threaded and is not integral with the plug. The stem moves slightly up and down as it turns without applying any endwise thrust against the plug. The threads provide a primary seal against leakage. A further seal is provided by a plastic packing which is forced into the annular packing groove with the packing injector. The floating coupling provides the connection between the stem and plug



9 CONICAL PLUGS in some lubricated valves are inverted as shown above. In this design, the stem is not integral with the plug. The floating coupling provides the connection between the stem and plug. The stem threads provide the primary seal against leakage. Plastic packing inserted mechanically with the packing injectors provides additional leak protection. The valve may be packed and lubricated while in service. Screwed bottom cover is used for working pressures from 3000 to 10,000 psig. Thrust adjustment is provided to compensate for wear and to obtain proper operation

The endwise thrust on the plug is applied through the single self-centering hardened steel ball at the lower end of the plug. The jacking action is applied through the lubricant chamber at the top of the plug.

Two designs of bottom covers are used in these valves. In one design, the cover is flanged and in the other, it is screwed.

The *flanged* bottom cover shown in Fig. 10 is used for general service at 3000 psig and less. The adjustment screw is entirely outside of the pressure zone. A flexible laminated metal diaphragm is clamped between the body and the bottom cover, sealing the lower end of the body and also the adjustment screw. The thrust created by the adjustment screw is transmitted through the diaphragm and the thrust ball to the plug. The cover has sufficient spring action to permit the slight movement of the plug which takes place at the time of adding lubricant.

The *screwed* bottom cover (Fig. 9), which is threaded into a fixed position with a buttress thread, is used for working pressures up to 10,000 psig. The threads on both the cover and the adjustment screw are sealed against leakage by annular grooves filled with plastic packing. These grooves are filled through two separate injectors. The spring disc and ball thrust are pressure balanced and, therefore, provide uniform pressure on the lubricant film regardless of the line pressure. The balanced adjustment feature is highly advantageous in the extreme pressure ranges for which this valve is designed.

Cylindrical Plug Valves

Straight cylindrical plug valves are available in sizes ranging for different patterns from ½ to 30 in. Screwed ends are made in sizes 4 in. and smaller. Flanged ends are available on sizes 1 in. and larger.

They are regularly made in steel and semi-steel. Some patterns are also made in stainless steel, aluminum, and many ferrous and non-ferrous alloys for special services.

When the lubricant system in the cylindrical plug type is completely filled, further application of lubricant increases the pressure on the top shoulder of the plug around the teflon gasket, which pushes the plug down slightly against the resistance of the plug support spring. This does not unseat the plug from the body seat. The action allows excess lubricant to squeeze past the top of the plug and gasket and relieve to the atmosphere around the neck of the plug, thus giving visible notice that the valve is filled. This lubricant release feature in the cylindrical type plug valve prevents excessive lubricant pressure inside the valve and also minimizes the amount of lubricant forced into the line.

Complete periodic and proper lubrication of these valves prevents corrosion, keeps the valve in proper working condition, and maintains a positive seal in the valve.

In the cylindrical plug valves, the gasket mounted on top of the plug seals against leakage about the shank.

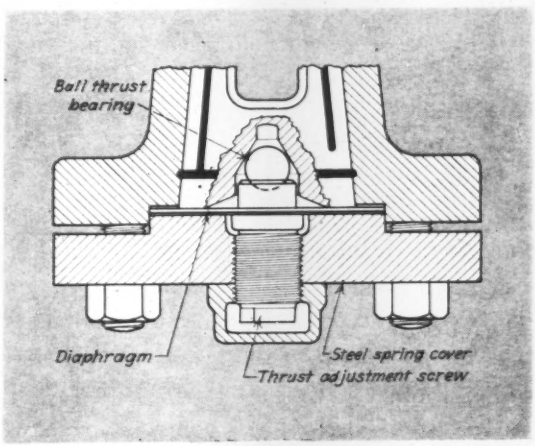
What Are Available Port Shapes?

Round and rectangular ports are available in most types of plug valves. The ports may be of the same area as the pipe or may be of reduced area. The latter, as in the case of non-lubricated valves, are smaller and less expensive but introduce higher head losses than the full area ports.

The body throats of some reduced port patterns are of venturi design. These are available in sizes 6 in. and larger. The use of venturi throats permits a reduced port through the plug with comparatively little increase in pressure drop over that for regular patterns. This results in savings of bulk and cost, and reduces operating torque. These valves are often used for gas service and many liquid services as well.

Lubricated valves with full area round ports are used for oil pipe lines and for applications where the line may be cleaned with a "scraper" or "go-devil". Like the "conduit" gate valve, they permit passage of the cleaning device and prevent the collection of sediment in the valve.

When a plug valve is used for throttling service, a plug with a diamond shaped port is generally used. More frequent lubrication will be needed in this service as the plug sealing grooves and body seats will be exposed to line fluid in some throttling positions. There will be some tendency for wire drawing to occur when the valve is nearly closed. However, a relatively small portion of the seating surfaces will be affected as compared to full exposure of the seats in globe and gate valves.



10 FLANGED BOTTOM cover above is used on valves of design shown in Fig. 9 for working pressures below 3000 psig. Diaphragm seals the adjustment and the lower end of the body

What Patterns Are Available?

Multiple port valves are made in two patterns, namely, three-way and four-way. The purpose of these valves is to divert or transfer the flow from one line to another.

The three-way is made with either a "tee" (Fig. 2) or an "ell" (Fig. 3) shaped port through the plug. The choice depends upon the service in which the valve will be used. The four-way is made with two "ell" shaped ports through the plug as shown in Fig. 4.

How Are They Operated?

To operate the valve, the plug must be rotated one quarter turn on the straight-way valve. In the use of the three-way valve, rotation may be from one quarter turn to three quarters of a turn, depending on the direction of flow required. Straight-way valves are regularly provided with checks that limit rotation of the plug. Checks are optional on multiple port valves and must be specified when desired. One of the common operating means is the square head for use with a wrench. Geared valves are available in large sizes for convenience in operation or for reduction of operating torque. They are regularly made with a hand wheel for operation. Other available operating means are: watertight gear housing and road boxes, and electric motor operators. Cylinder operators are available for operation with air, gas, oil, or water. Standard cylinders are made for various ranges of operating pressure up to 200 psig.

Designs for Special Applications

Lubricated plug valves and accessories are available for a number of special applications. Some of these are given below.

The *short pattern* flanged end, straight-way valves have face-to-face dimensions conforming to ASA B16.10. These patterns are intended for use where the valve is to replace a gate valve. In conical-plug type valves, the area of the plug port is between those of the regular and venturi patterns. The throats in these are of venturi design.

Short pattern cylindrical plug valves are available in most sizes with both full size and venturi plug port areas.

For handling viscous liquids such as asphalt, and other materials that must be heated, plug valves are equipped with *steam jackets* having tapped bosses for steam supply and condensate drainage. The jacket is cast integral with the body and completely encloses the plug seat area and the body throats in valves with conical plugs. These valves are available in semi-steel. The body size is increased and the end flanges are one or more sizes larger. In the cylindrical valve, only the base plate is steam jacketed. The standard base plate shown in Fig. 8 is removed and replaced with a steam jacketed plate. These plates are available for all standard patterns.

Watertight gear enclosures with extension stems and position indicators are available for underground service. Valves are also available with extension stems and road boxes for underground service and with extension stems and floor stands for remote operation. Provisions for both lubrication and operation from remote locations are included in the extension stems.

Special patterns are also available for oil field applications such as flow line, drilling, and mud valves. Provisions for locking may also be obtained.

Select Convenient Form of Lubricant

Valve lubricants are available in three different forms. These are plastic "sticks" that are inserted after removing the lubricant screw, bulk form of the same consistency as "sticks" that can be rolled into sticks or applied with screw type guns, and bulk form of softer consistency that can be applied by quick acting pump grease guns.

The wide variation in the physical characteristics of the many lubricants available makes it necessary to offer them in these several forms. Selection is based upon satisfactory operation and user preference with respect to application. Most lubricants are available in "stick" form. Some special lubricants can be supplied only in bulk form because of their consistency.

Lubricants should be obtained from the same source as the valve to insure proper lubrication. Grease not produced especially for lubricated plug valves should *never* be tried or used.

When selecting lubricants, the following things must be considered:

1) Maximum working pressure.

2) Maximum temperature, or if for extremely cold service, the minimum temperature.

3) The characteristics of the material handled. Such things as whether it is in the gaseous, liquid, or vapor state; acid or alkaline; and whether it is water, steam, oil, or chemicals must be considered.

It should be noted that high temperature lubricants prevent sticking or hard turning, particularly where valves have remained in one position for a long period of time.

When selecting plastic packing for sealing the stem, and other parts of inverted conical plug valves, the same considerations listed for the selection of lubricant apply. The plastic packing should *never* be used as a lubricant.

Periodic Lubrication Is Essential

A number of engineers were asked to relate their experience with these valves. The most frequent word of caution with regard to the use of lubricated plug valves was the dissipation of lubricant with subsequent binding of the plug. The range of service conditions represented in their replies was as follows:

1) Water — temperatures ranging from 34 to 325 F with pressures up to 250 psig.

2) Gas — temperatures from ambient to 180 F and pressures ranging from a few inches of water gage to 375 psig.

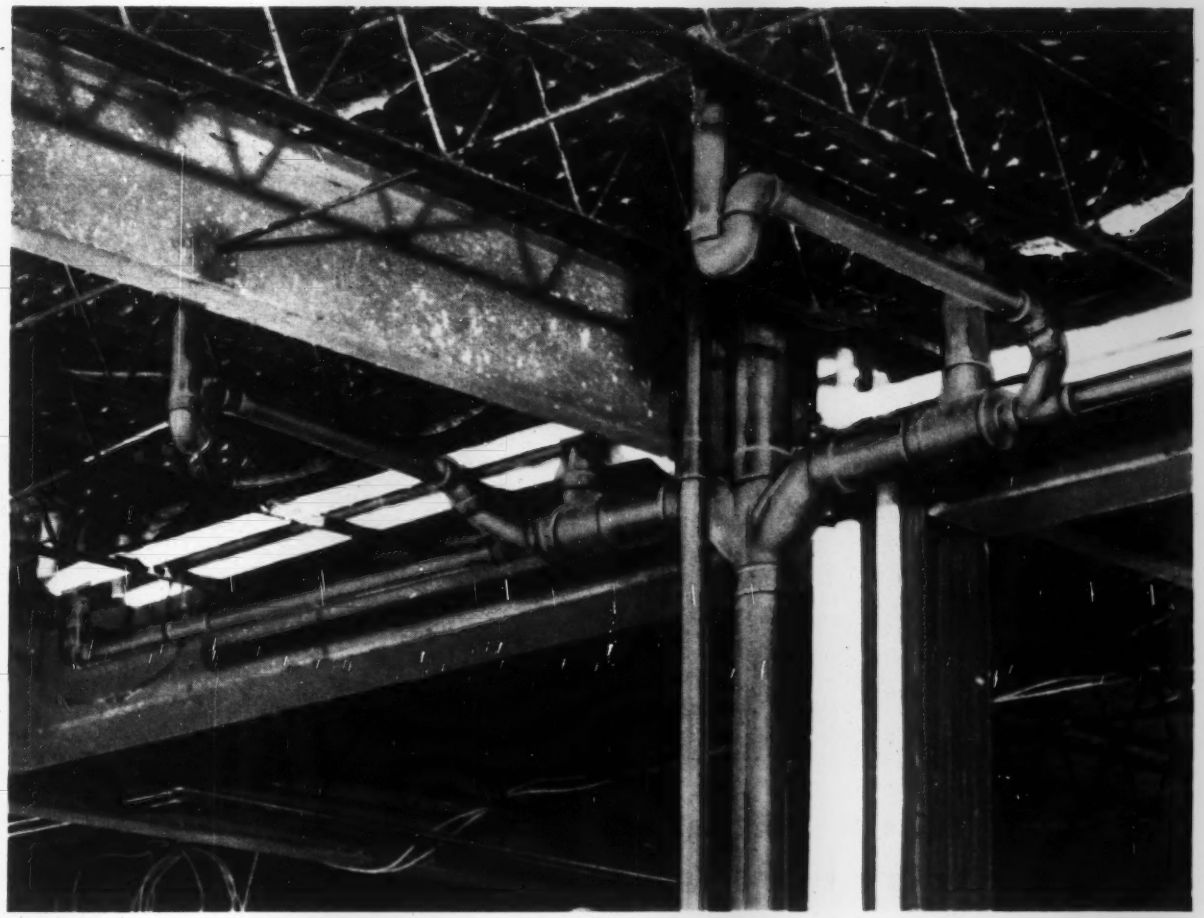
3) Oil — temperatures from 80 to 250 F and pressures to 300 psig.

4) Air — temperatures to 250 F and pressures up to 250 psig.

5) Steam — maximum pressure of 250 psig.

6) Caustic slurries — temperatures to 210 F and pressures to 100 psig.

The lubricant will be dissipated in service at a rate which is dependent upon service conditions, such as the fluid handled, pressure, temperature and frequency of operation. Since the lubricant is important in the proper functioning of the valve, successful application depends upon maintaining the lubricant film fresh and continuous over the seating surfaces. The valves must be lubricated periodically to minimize leakage and to prevent binding of the plugs.



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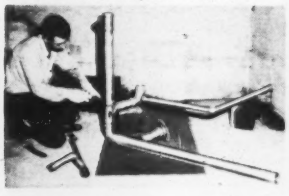

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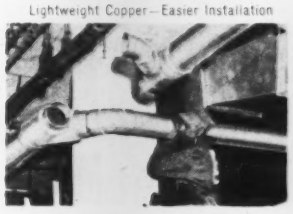

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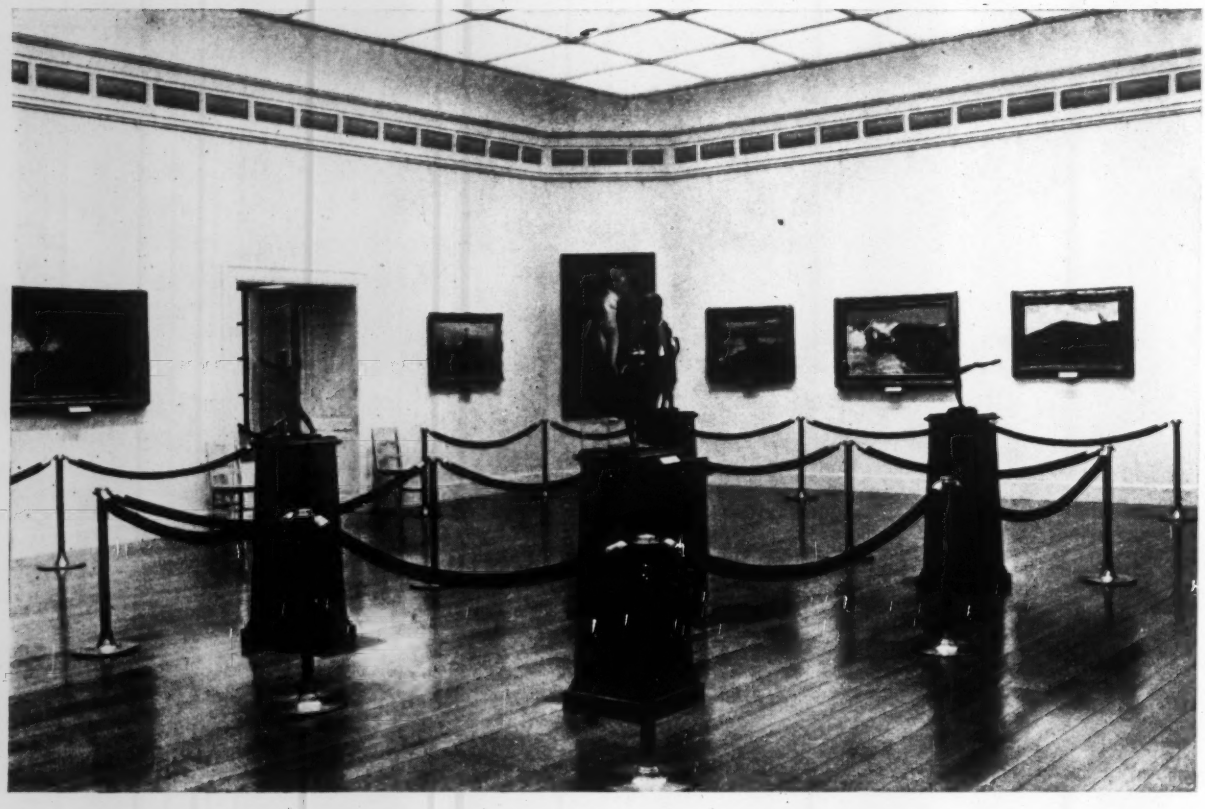
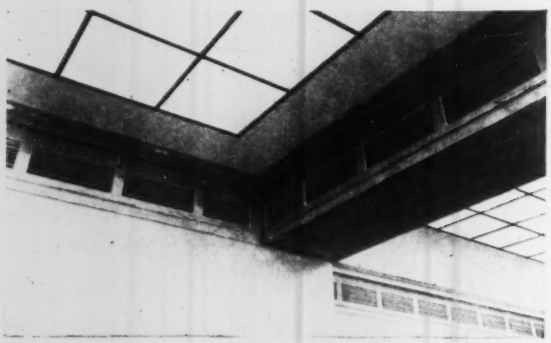
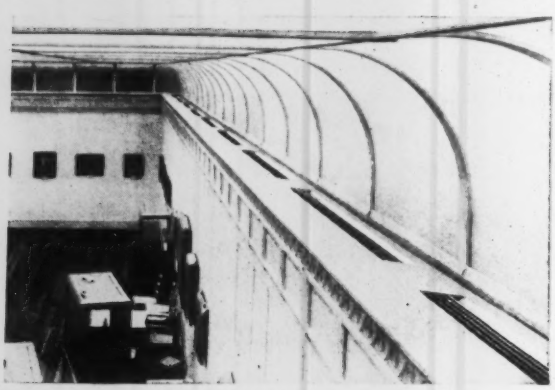


Draftless Anemostat Air Diffusers at Sterling and Francine Clark Art Institute





The photograph above illustrates an Anemostat Straightline Air Diffuser installation in the gallery design of the Sterling and Francine Clark Art Institute at Williamstown, Mass. The conditioned air is supplied through Straightline Diffusers located on all four sides of the gallery. The diffusers not only draftlessly introduce conditioned air into the gallery, but also blend into the architectural design.

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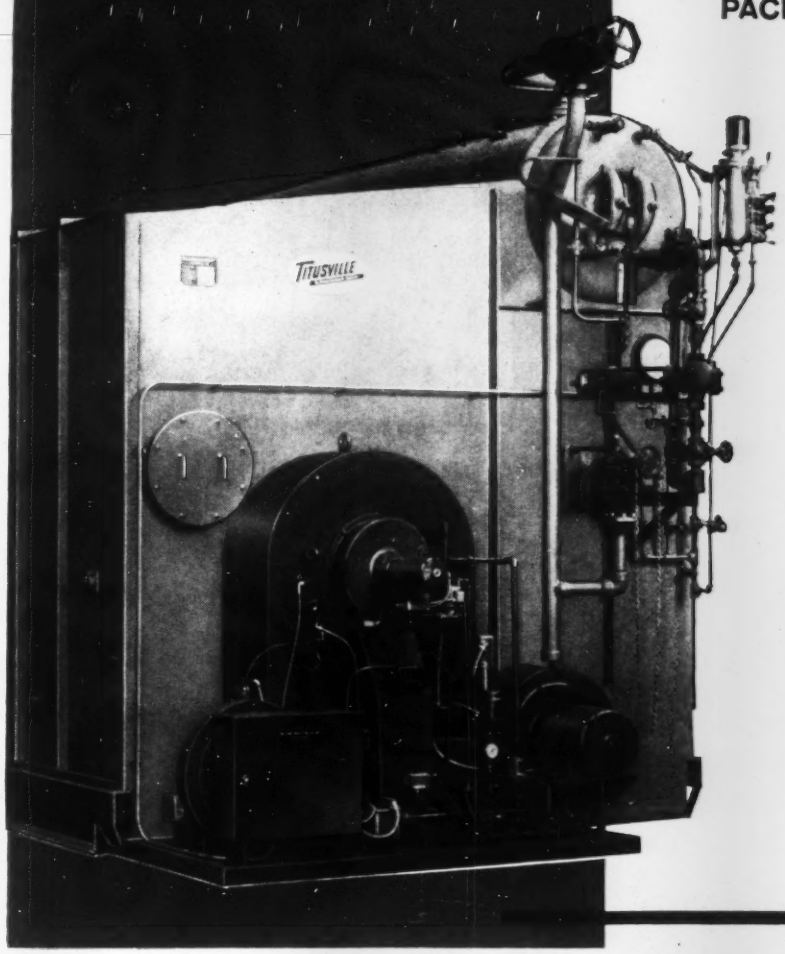

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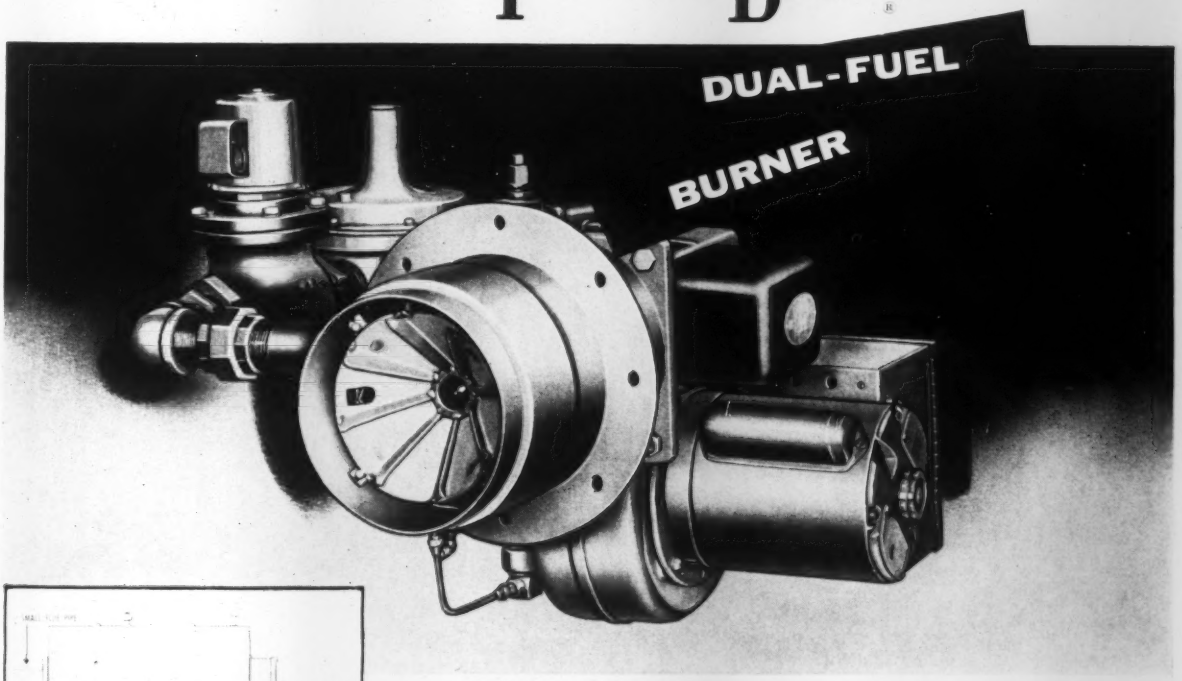

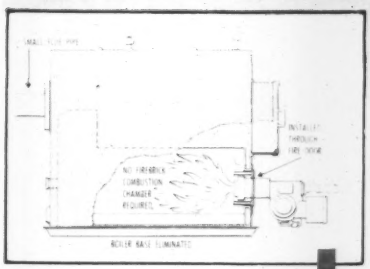

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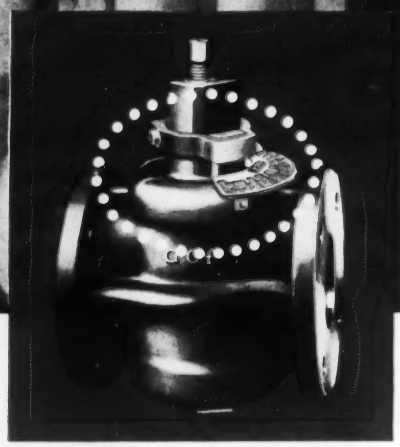

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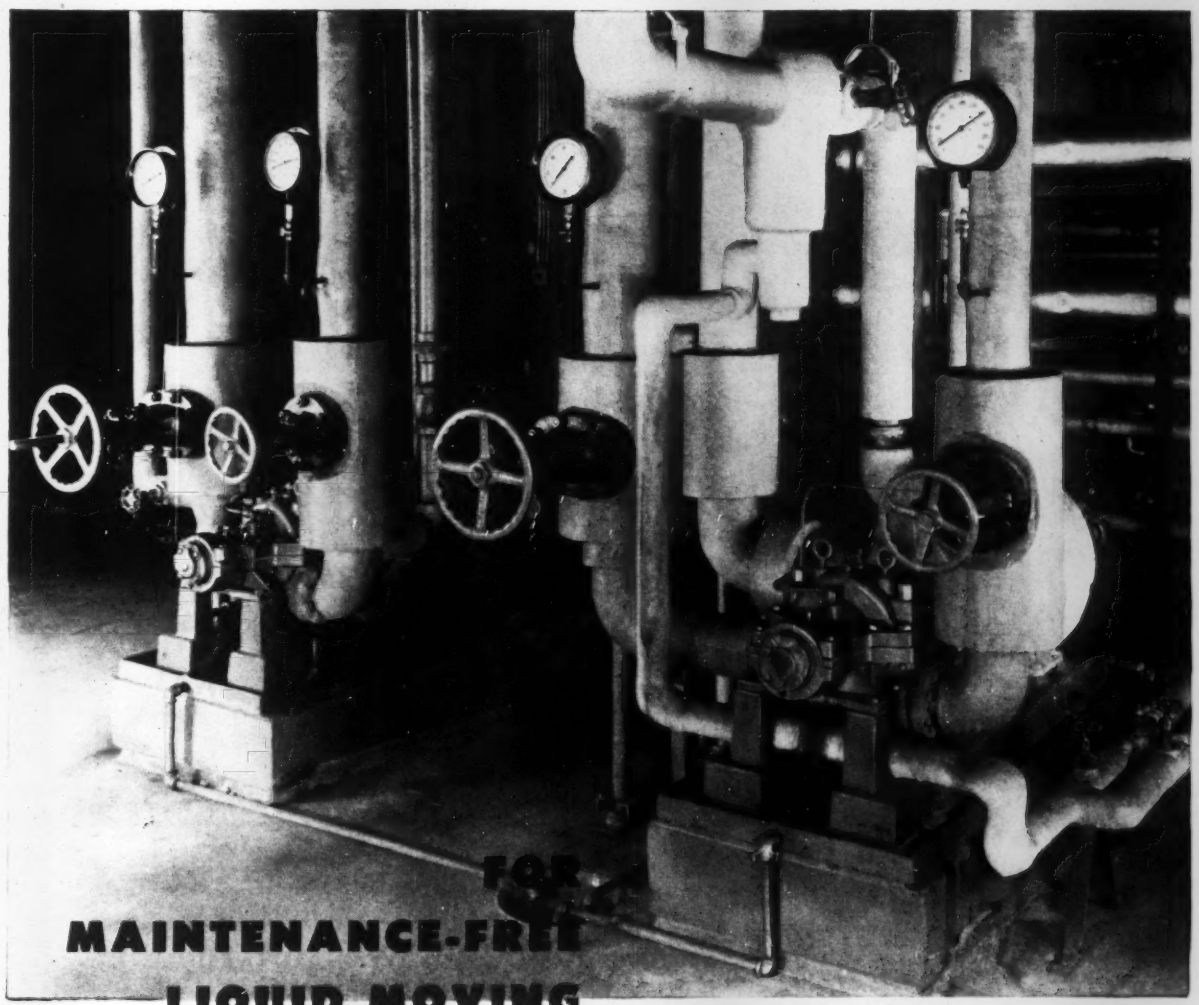

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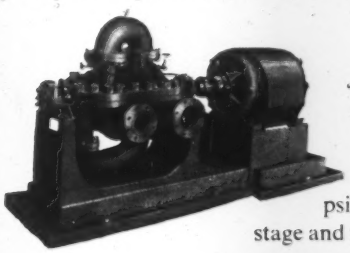

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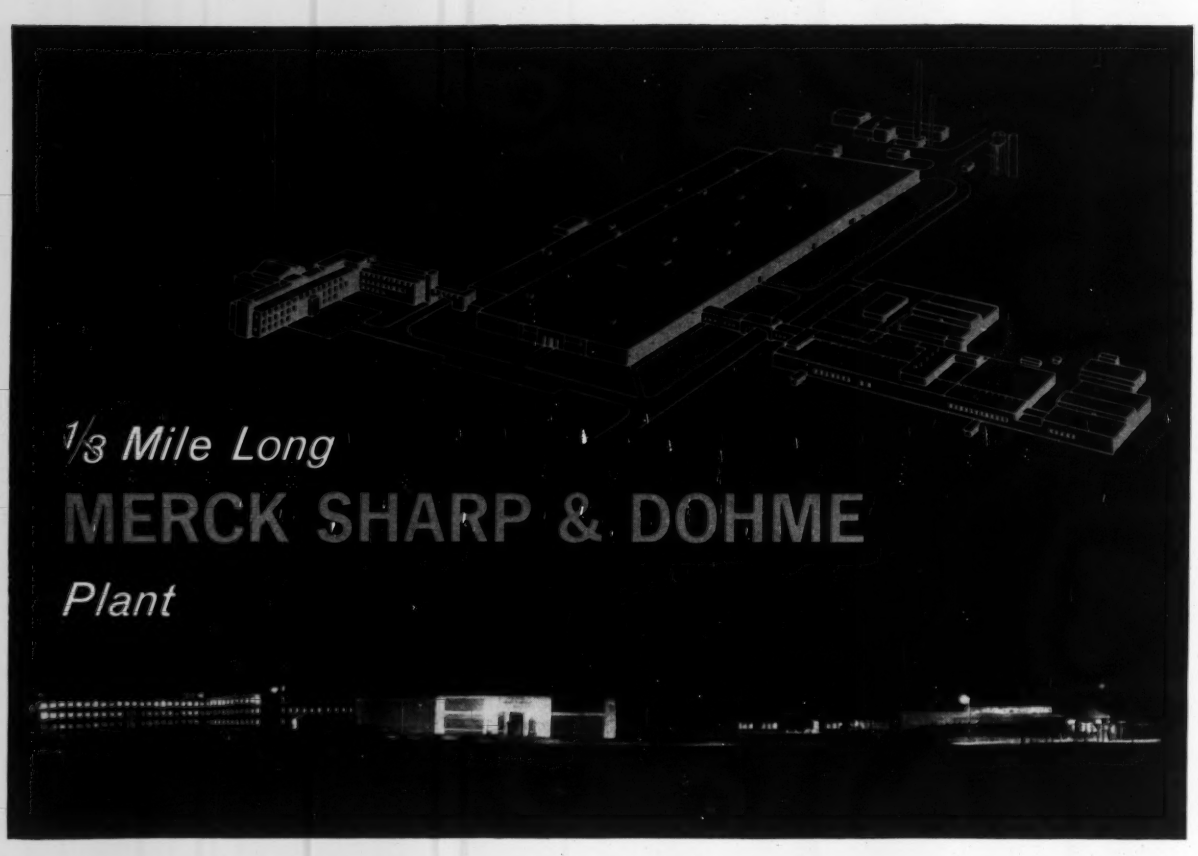

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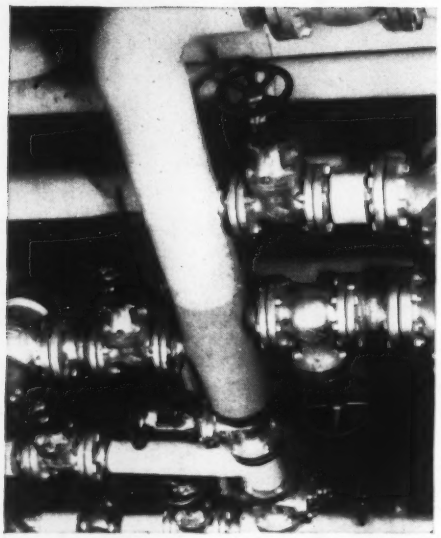

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EQUIPMENT DEVELOPMENTS . . .

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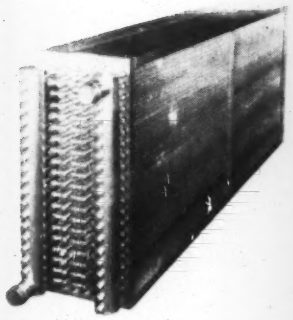
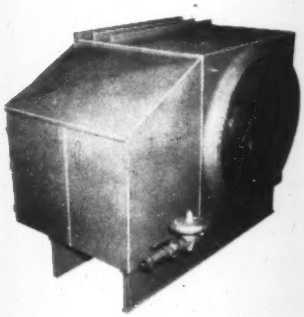


Water-Cooling Coils . . .

. . . in "cleanable" design—*Halstead & Mitchell, Dept. HPAC, Bessemer Bldg., Pittsburgh 22.*

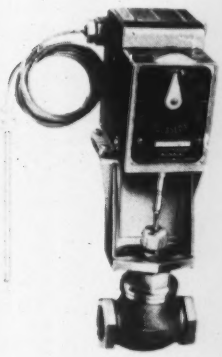
Coils consist of seamless copper tubing of $\frac{5}{8}$ in. OD and spaced on $1\frac{1}{2}$ in. centers. Coils available with finned surface dimensions from 12 to 36 in. high in 3 in. multiples. Lengths range from 24 to 120 in. in 6 in. multiples. Coils built with 1 to 8 rows, with fins running 6, 7, 8, or 10 to the inch.



Make-up Air Unit . . .

. . . developed to provide high combustion efficiency for supplying tempered outside air to replace air removed by industrial exhaust systems—*Hartzell Propeller Fan Co., Dept. HPAC, P. O. Box 909, Roosevelt Ave., Piqua, Ohio.*

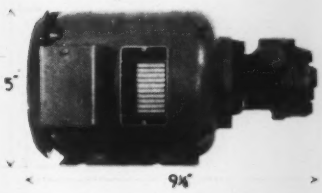
Unit burns natural or propane gas in line-of-flame burner directly in entering air stream. Combustion products mixed with large volumes of outside air to eliminate contamination of air in building. Models rated at 2, 4, 6 million Btu per hr. with air volumes of 25,000, 50,000, 75,000 cfm. Bulletin "A-115" available from manufacturer gives complete description of product.



Temperature Regulator

. . . intended for proportional control of water, gas, or low pressure steam—*Barber-Colman Co., Dept. HPAC, 1701 Rock St., Rockford, Ill.*

Temperature regulator has self-contained construction; clearly marked calibrated adjusting dial; electric industrial motor operator; armored capillary tubing. Applications include control of package air conditioning units; hot water storage tanks; industrial process control.



Close Coupled Pump . . .

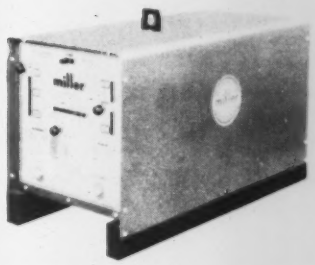
. . . developed specifically for applications where space and weight are important factors—*Tuthill Pump Co., Dept. HPAC, 939 E. 95th St., Chicago 19.*

New "Series 42" close coupled pump unit measure $9\frac{1}{8} \times 5$ in. Totally enclosed electric motor rated for 1/12 to 1/6 hp. Internal gear pump has capacity of 1/3 to 3 gpm.

Oil-Gas Fuel Burning Unit

. . . developed for firing either oil or gas or combination of both—*Engineer Co., Dept. HPAC, 75 West St., New York 6.*

Features of fuel burning unit are hand-wheel on air register to control setting of air vanes through chain and sprocket for clockwise or counter-clockwise air rotation; vane-mounting shafts of stainless steel turning in carbon graphite bearings; register made to fit range of burner housing depths. Unit offered with variety of oil or gas burners, including standard and wide range atomizing oil burners, steam or air atomizing oil burners and gas burners of ring or gun type.



Pipe Welding Machine . . .

. . . with rated output for both a-c and d-c of 250 amp at 30 volt on 40 percent duty cycle or 200 amp at 40 volt on 60 percent duty cycle—*Miller Electric Mfg. Co., Dept. HPAC, 718 S. Bounds St., Appleton, Wis.*

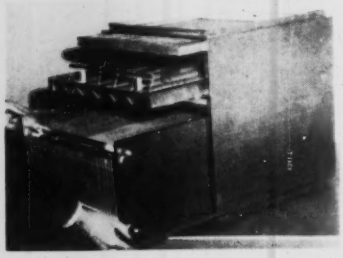
"Big Twin" a-c/d-c transformer-rectifier type welder has a-c ranges of 20 to 125 amp and 60 to 290 amp; d-c ranges of 18 to 400 and 65 to 290 amp. Operates from single phase service with infinite current adjustments from movable shunt type transformer. Unit is $25\frac{1}{2}$ in. high.

EQUIPMENT DEVELOPMENTS
Continued

Plastic Valves

. . . recommended by manufacturer for low and medium pressures and temperatures (150 psi at 72 F)—*Walworth Co., Dept. HPAC, 750 Third Ave., New York* 17.

New addition to manufacturer's line of plastic valves are 3 in. polyvinyl chloride Y-globe valve, check valve, and strainer. PVC construction gives valves high corrosion resistance, according to the manufacturer.



Electronic Air Cleaner . . .

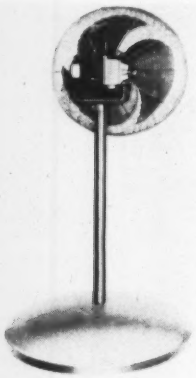
. . . "patterned after units developed for atomic submarines"—*Trion, Inc., Dept. HPAC, 1000 Island Ave., McKees Rocks, Pa.*

"Model LCT" electronic air cleaner designed for either horizontal or vertical air flow. All parts, including collector cell, can be removed from cabinet for cleaning. Unit has efficiency rating of 90 percent or better, according to company, removing particles from air down to one/2.5 millionth of an inch.

Continuous Convector . . .

. . . combines high heat capacity characteristics of convector with finned tube radiation—*Modine Mfg. Co., Dept. HPAC, 1509 De Koven Ave., Racine, Wis.*

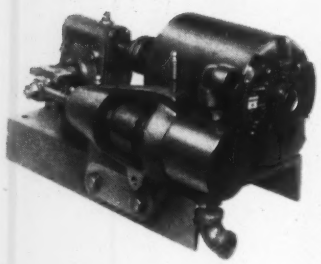
"Perma-Trim Wall-to-Wall" convector uses two or three 1 in. OD tubes. Available in 4 and 6 in. depths, in 10, 14, 20, 26 in. heights and in 3, 4, 5, 6, 7, 8, ft lengths. Extension sleeves and corner pieces available extending total enclosure length up to 12 in. at each end.



Cooling Fans . . .

. . . designed for use in hazardous locations—*Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago* 41.

Cooling fans have constant speed type explosionproof motors. Available are 115 or 230 volt, 1 phase, 60 cycle units and 220 or 440 volts, 3 phase, 60 cycle units. Fan wheels are of nonferrous construction. Units furnished with explosionproof starter, mounted and wired to motor with rigid conduit; explosionproof cable and cable connector available.



Metering Pump . . .

. . . developed for clear and corrosive liquids—*Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia* 18.

"Model CM" metering pump delivers maximum capacities to 28 gph in simplex designs and 56 gph in duplex designs. Unit will handle pressures to 1100 psi. Pump uses standard drive of ½ hp constant speed electric motor.

Pressure Reducing Valve

. . . with screw adjustment—*Klipfel Valves, Inc., Dept. HPAC, 1075 Lincoln Ave., Hamilton, Ohio.*

"KP-59" external pilot operated steam pressure reducing valve has stainless steel ball inner valve; tapered opening between inner valve and beveled seat ring; 12 in. main valve diaphragm of stainless steel. Available in sizes from ¾ to 4 in. with bronze, semi-steel or cast steel bodies; screwed ends offered in sizes to 3 in.; flanged bodies available in sizes 1¼ to 4 in.

Liquid Sensor . . .

. . . designed to detect presence or absence of cryogenic liquids or fuels in transfer line or vessel—*Minneapolis-Honeywell Regulator Co., Missile Equipment Div., Dept. HPAC, Pottstown, Pa.*

Liquid sensor is three-part control unit consisting of detector probe, amplifier, and connecting coaxial cable. Probe detects level of liquid gases, fuels within 1/16 in. or less and will withstand maximum pressure of 250 psi at −297 F and liquid velocity of 18 fps. Amplifier operates an ambient temperature range of zero to 140 F.

US RUBBER EXPANSION JOINTS

How to keep your cost accountant contented

Just ask him to amortize the cost of a U.S. Rubber Expansion Joint.

He will have a pleasant time discovering that these joints never seem to wear out. Some have been in use for 30 years and are as sturdy as ever. No other rubber expansion joints have been in use that long.

"U.S." Expansion Joints are the only joints that have withstood this test of time. As for value, "U.S." Expansion Joints remain the cost accountant's delight. Other so-called "just-as-good" joints costing a few dollars less can rob you of many times their complete cost when they cause downtime.

Your accountant will tell you that "U.S." Expansion Joints comprise shrewd, logical insurance. These joints are the economical, flexible connections used in all kinds of pipe lines to take care of misalignment, vibration, expansion, contraction and noise transmission. No moving parts to wear or bind; can be installed on new or old equipment.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

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WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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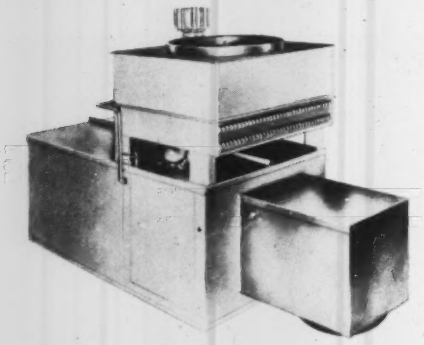
EQUIPMENT DEVELOPMENTS

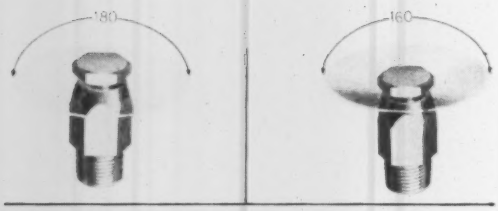
Continued



Year 'Round Air Conditioner . . .

. . . designed for roof mounting—*Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC, 505 Carroll St., Brooklyn* 15.

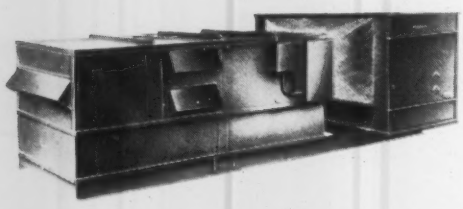
Packaged air cooled air conditioner and gas fired heater combination available in two sizes with nominal air conditioning capacities of 5 and 8 tons. Unit provides 160,000 Btu per hr heating capacity.



Spray Nozzle . . .

. . . for industrial applications—*Wm. Steinen Mfg. Co., Dept. HPAC, 13 Bruen St., Newark, N. J.*

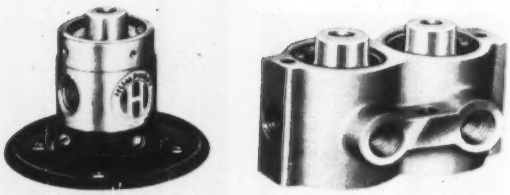
"Span-Jet" spray nozzle produced in two styles to provide either 180 deg flat, circular spray pattern or a 160 deg hollow-cone spray pattern. Nozzles made in capacities from 0.75 to 10 gpm per min at 10 psi pressure. Standard nozzles made with male connection to fit pipe sizes of $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{8}$ in. Available in brass, 303 stainless steel, or special materials as required.



Packaged Air Conditioners . . .

. . . provide cooling capacity of $7\frac{1}{2}$ and 10 tons—*Carrier Corp., Dept. HPAC, Carrier Pkwy., Syracuse 1, N. Y.*

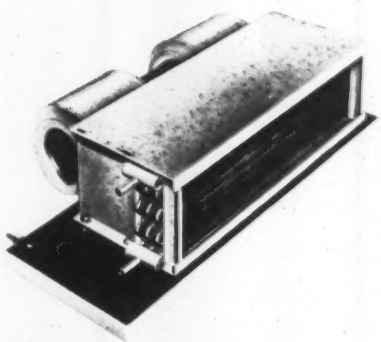
Year 'round air conditioners available in two sizes: 200,000 Btu per hr input heating capacity with gas and cooling capacity of $7\frac{1}{2}$ tons; and 250,000 Btu per hr heating with 10 tons of cooling capacity. Units can be installed on roof of single story building, require no ductwork. Damper controls mixture of outside air.



Pilot Operated Valves . . .

. . . for automatic or manual control of air, gas, vacuum and liquid flow—*Humphrey Products, Div. of General Gas Light Co., Dept. HPAC, 202-PP N. Park St., Kalamazoo, Mich.*

"Quick-Dump" piloted valves designed for original equipment and plant pressures to 125 psi. Ports are full-rated capacity throughout in 2 and 3 way sizes of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ in. and 4 and 5 port $\frac{1}{4}$ in. models available for double acting cylinder control. Pilot line connectors are all $\frac{1}{8}$ in. NPT. Bodies available in machined solid steel, cadmium plated high tensile iron or cast brass, normally open or normally closed. Valves operate in temperatures from —65 to 225 F.



Horizontal Air Conditioner . . .

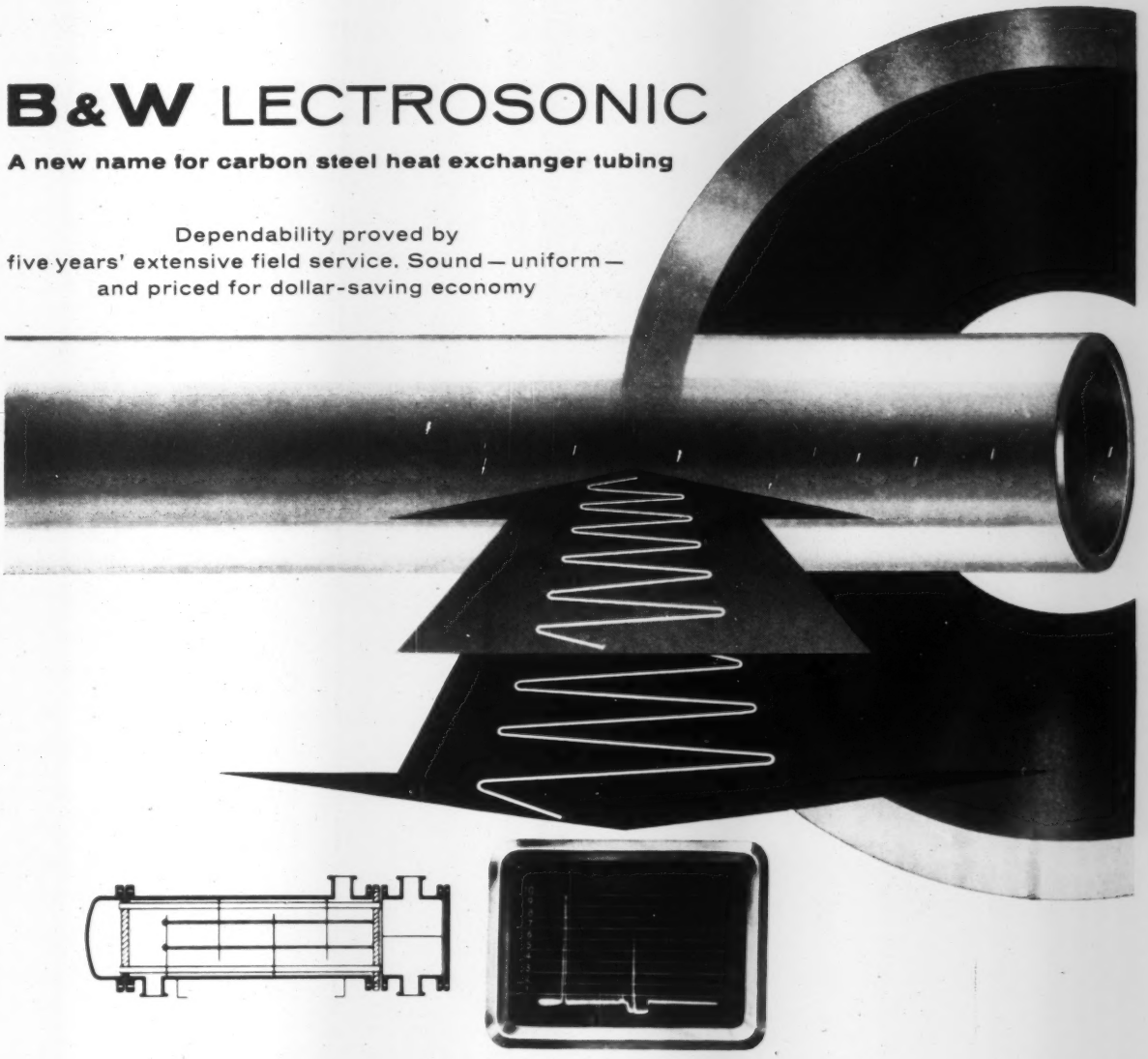
. . . designed for use with hot or chilled water in concealed overhead installations—*American-Standard, Plumbing & Heating Div., Dept. HPAC, 40 W. 40th St., New York* 18.

"Type 30 Remotaire" horizontal air conditioner for small commercial installations, may be installed in concealed locations such as dropped ceilings or closets. Design incorporates large surface area 3-row coil, is said to eliminate all metal-to-metal contact between pan and bottom of coil.

B&W LECTROSONIC

A new name for carbon steel heat exchanger tubing

Dependability proved by
five years' extensive field service. Sound — uniform —
and priced for dollar-saving economy



Now, B&W brings you a new concept in heat exchanger tubing—B&W LECTROSONIC. Produced under the most exacting quality control methods in the industry, LECTROSONIC tubing fits right, and rolls in easily because it's dimensionally accurate, and uniform.

Continuous ultrasonic inspection—plus destructive and hydrostatic testing, visual inspection, and magnetic particle inspection, are five ways used to check the weld of B&W LECTROSONIC Tubing for your assurance of dependability.

B&W LECTROSONIC Tubing was developed to meet the needs of the petrochemical industry for an electric resistance welded carbon steel tube that is easily workable, strong, and less costly than seamless tubing which it is designed to replace.

Produced in all standard sizes. Available now through distributors or direct from B&W.

Write for B&W Bulletin TB-431 for full information, or call your nearest B&W District Sales Office. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

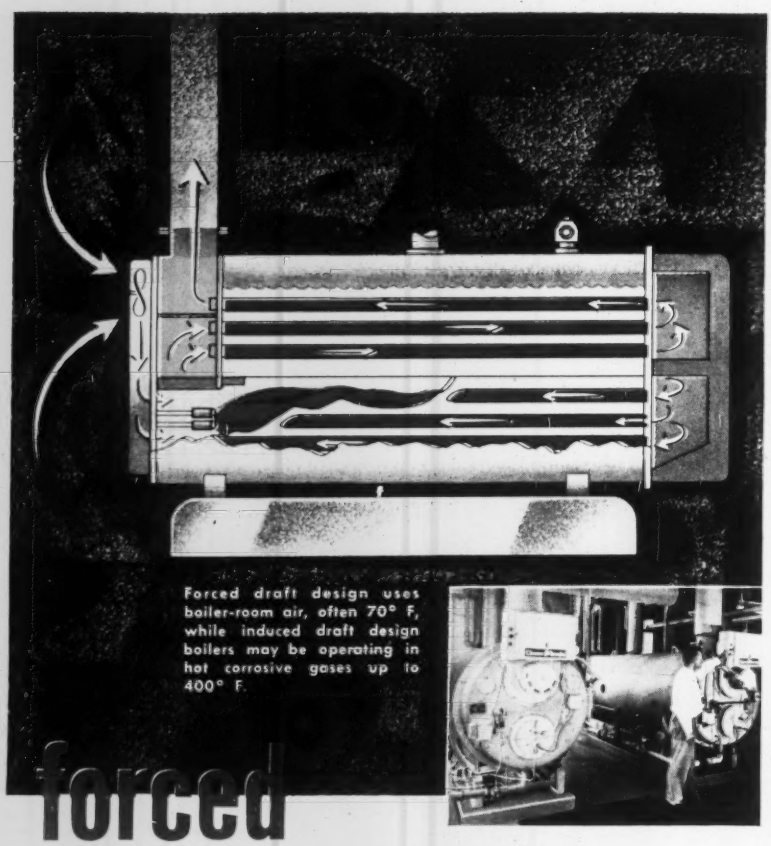
B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9034-WPS

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals



Forced draft design uses boiler-room air, often 70° F, while induced draft design boilers may be operating in hot corrosive gases up to 400° F.

forced draft design:

How Cleaver-Brooks packaged boilers use cool air to heat more efficiently

FORCED DRAFT DESIGN PROVIDES positive draft with a vibration-free fan, delivering cool, clean boiler room air for combustion at constant density and volume. Efficient combustion, clean fire and stable flame are assured through air-fuel ratios automatically controlled and balanced for a modulating fire, and to meet varying load demands. No high chimney or large diameter breeching are required; only a simple vent is needed.

Since the forced draft fan moves only cool, clean boiler room air, it is never exposed to the sooting and corrosive effects of hot gases; it requires little maintenance and is lower in initial cost.

4-PASS FIRE TUBE DESIGN squeezes maximum heat out of every fuel unit . . . maintains high flue-gas velocity . . . assures optimum heat transfer.

UPDRAFT CONSTRUCTION with low furnace keeps hottest gases well below water level for safe operation.

5-SQ. FT. OF HEATING SURFACE per boiler hp for top heat transfer, prolongs boiler life, assures greater efficiency and lower maintenance.

This exclusive combination of Design Standards is the key to the superiority of Cleaver-Brooks packaged boilers — 15 to 600 hp, 19 sizes, 130 models; steam or hot water; oil, gas or combination oil/gas fired; parts and service available anywhere in the U.S. and Canada.

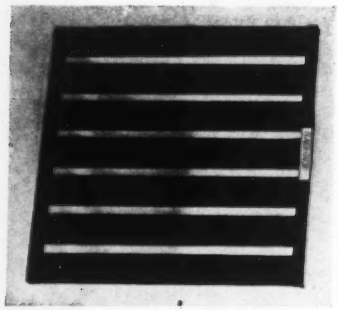
For details, contact our representative or write Cleaver-Brooks Company, Dept. J, 313 E. Keefe Avenue, Milwaukee 12, Wisconsin.

Cleaver Brooks

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

EQUIPMENT DEVELOPMENTS

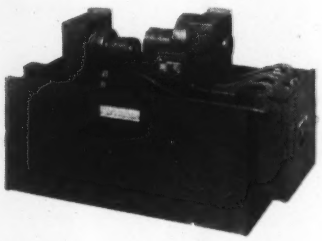
Continued



Odor Absorber . . .

. . . design based on activated charcoal—*Barnebey-Cheney Co., Dept. HPAC, Cassady at Eighth, Columbus 19, Ohio.*

"Partial Air By-Pass" odor absorber is 1 in. thick, made in four standard sizes. Said to be especially suited for low and intermittent odor loads; efficiency per air pass is rated at 20 percent. When charcoal becomes saturated with odors, it can be changed on job.



Air Dryer . . .

. . . developed for continuous dehumidification of laboratories, test rooms, small storage areas—*Dryomatic Corp., Dept. HPAC, 806 N. Fairfax St., Alexandria, Va.*

"Model 50" air dryer provides continuous, low-volume flow of dehydrated air, removing up to 24 lb of water per 24 hr, and holding 10 percent RH in confined spaces up to 17,500 cu ft, according to manufacturer. Unit delivers 50 cfm of dry air by alternate utilization of two beds of permanent silica gel drying agent.

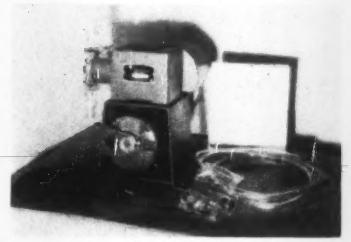
Pipe Welding Machine . . .

. . . developed for aluminum pipe welding—*Aluminum Co. of America, Dept. HPAC, 1501 Alcoa Bldg., Pittsburgh 19.*

EQUIPMENT DEVELOPMENTS

Continued

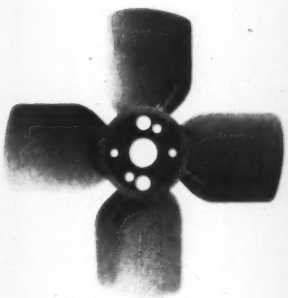
Welder designed to produce sound welds with full penetration without use of back-up rings. Unit completes pass on 4 in. pipe in 11 sec, according to manufacturer; processes tubular products with outside diameters of from 4 to 11 in.



Proportioning Pump . . .

. . . designed for positive control of materials in motion—*B-I-F Industries, Inc., Dept. HPAC, 345 Harris Ave., Providence 1, R. I.*

"Model 1210 Chem-O-Feeder" proportions chemical solutions, acids, and alkalies to process water in industry. Available in three models: "Simplex," "Duplex," and "Triplex," for adjustable wide-range proportioning up to 12, 24, 36 gph with discharge pressures up to 125 psi.



Plastic Fan . . .

. . . produced in acrylo-nitrile-copolymer plastic for high volume air moving devices—*Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

New 4 in. diam plastic fan designed for operating efficiency, smooth performance at speeds up to 11,000 rpm. "GU Series" fan designed for unit bearing mount.

new redesigned

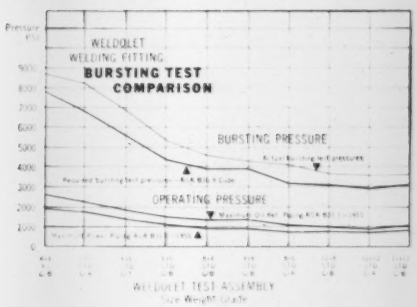
BONNEY WELDOLETS

for reinforced branch connections on carbon steel and alloy pipe

Welding fittings manufactured and tested in accordance with ASA B16.9 and ASA B31.1

clean-cut bevel with exactly 1/16" land
bore machined with a watchmaker's precision and finish
reduced angle of bevel . . . weld volume cut almost 50%
weld line clearly defined . . . no more errors about "how much to weld"
skirt taper redesigned for improved stress distribution

RESULTS? OVER 4½ TIMES MAXIMUM OPERATING PRESSURE



BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

• • • • • • • • • • • •

CARBON STEEL
STAINLESS
ALLOY
for all services

For high strength and low-total installed cost compare with . . . other reinforced branch construction . . . unreinforced branch construction . . . and welding tee construction. Then specify and use Weldolet fittings for all full size and reducing branch connections.

BONNEY FORGE AND TOOL WORKS

ALLENTOWN, PENNSYLVANIA

Keep pace with your space . . .

CYCLOTHERM

provides for

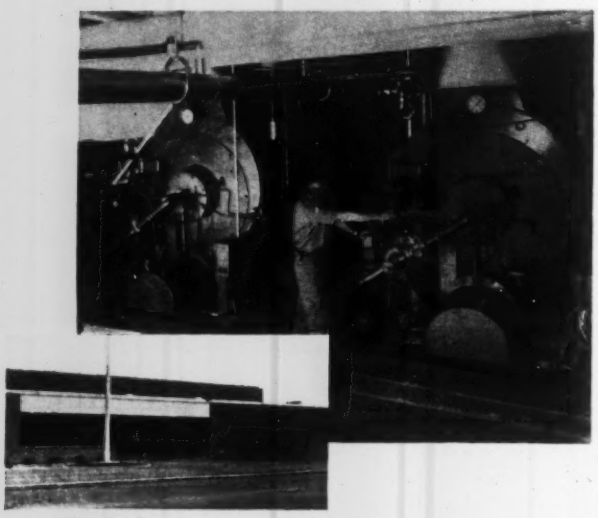
tomorrow's heating today

The Cyclotherm you install today will meet your steam requirements for many years to come. But time does fly and businesses do grow. And when you make a plant addition 18 Cyclotherm models, with 18 different boiler horsepowers, are ready to match new space with new heating capacity.

The Cyclotherm Steam and Hot Water Generator is built under one roof with one manufacturing responsibility backing the entire equipment—shipped fire-tested and ready to operate. Up to ⅓ smaller than other package generators of same capacities and needing no excavation, no foundation, no costly stack.

Electronic controls operate the Cyclotherm automatically. On units of 80 HP or more, modulation controls regulate firing rate from 30% to 100% of rated capacity without loss of efficiency. Smaller models automatically *off* when steam demands are satisfied, automatically *on* when more steam is needed. Operation stops if firing sequence is interrupted and unit fails safe. Cyclotherm cuts maintenance costs by up to 50%.

Cyclotherm meets all state requirements, conforms to A.S.M.E. and National Board standards, carries Underwriters' Laboratories label. Burns oil and/or gas. Steam generators: 15 to 750 HP. Hot water Generators: 670,000 to 6,700,000 BTU per hr.



At the Frederick Leighton School, Oswego, N. Y., two 100 HP Cyclotherms keep 21 classrooms and 550 pupils warm and comfortable. Building designed by Ketcham-Miller-Arnold Architects of Syracuse, N. Y.; Consulting Engineer Cedric R. Acheson, also of Syracuse.

YEARS AHEAD IN STEAM & HOT WATER GENERATION

CYCLOTHERM®
Steam & Hot Water Generators

Division of National-U.S. Radiator Corp.
55 E. First St., Oswego, N. Y.

Clip to Your Letterhead:

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Please send me full information about Cyclotherm Steam and Hot Water Generators.

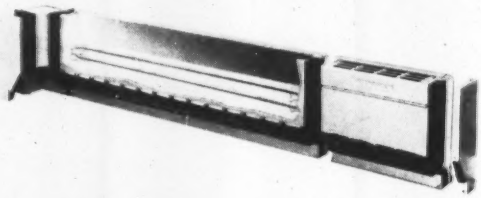
EQUIPMENT DEVELOPMENTS

Continued

Underground Pipe Insulation . . .

. . . of vermiculite insulating concrete—*Concrete Thermal Casings, Inc., Dept. HPAC, Seattle, Wash.*

"CTC" cased thermal concrete designed for applications where conduits are covered by water. Nonmetallic casing resists corrosion, prevents water migration. "Z-Crete" has tough vinyl watertight membrane designed for stability at high temperatures. Intended for applications involving periodic water coverage. Water resistant "b-t-u" monolithic conduit is unaffected by boiling water, intended for applications in dry areas where water may occasionally stand over conduit, says manufacturer.



Electric Baseboard . . .

. . . available in 4 or 6 ft sections—*Westinghouse Electric Corp., Dept. HPAC, P. O. Box 2099, Pittsburgh 30.*

Baseboard has heating capacity of 250 watts per lineal ft. Three-way airflow keeps surface temperature low enough to touch. Thermostat maintains room temperature within 2 F of room temperature.

Spray Nozzles . . .

. . . with adjustable joints—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

Range of adjustable joint sizes for manufacturer's spray nozzles includes all capacities from those for ¼ in. pipe connection to larger units for 2½ in. pipe connection. Materials used include brass, steel, and stainless steel. Ball and socket design permits positioning, rotating nozzle at any angle in 40 to 50 deg arc range.

Pipe Jacketing . . .

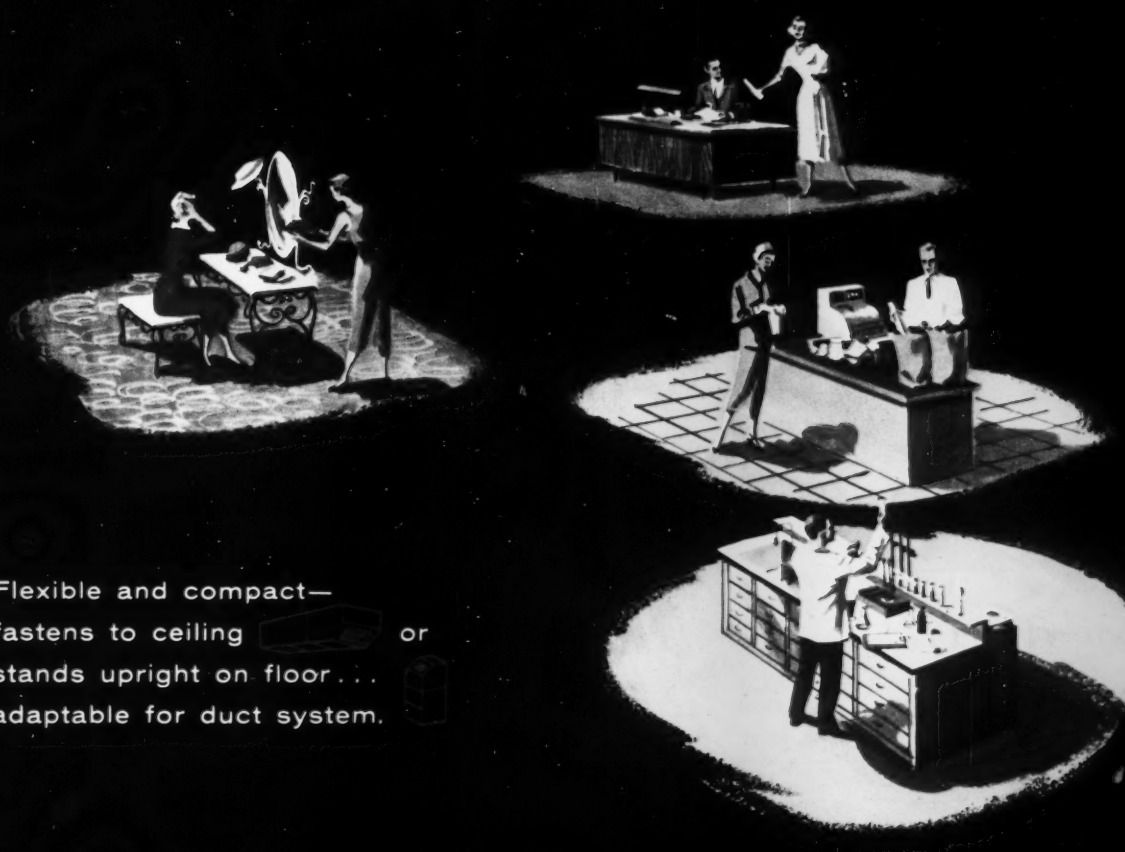
. . . with new fire retardant properties—*American Sisalkraft Corp., Dept. HPAC, 55 Starkey Ave., Attleboro, Mass.*

"Pyro-Kure" is composed of foil and kraft paper bonded together with flame-extinguishing adhesive to make fire-resistant vapor barrier. When temperature surrounding material reaches combustion stage, gases or vapors released tend to smother flame.

the quality tells . . . the quality sells

JANITROL

packaged air conditioner



Flexible and compact—
fastens to ceiling or
stands upright on floor . . .
adaptable for duct system.

Easy solution to a wide range of residential and commercial cooling problems . . .

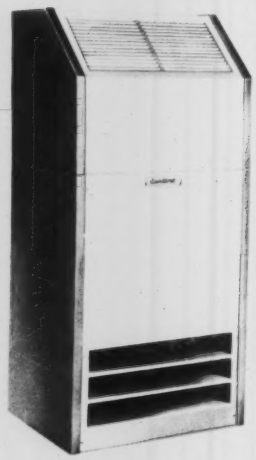
new

COMPACK

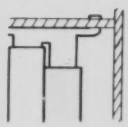
"packaged" waterless cooling conditioner

This versatile new cooling conditioner lends itself to an exciting variety of cooling applications . . . meets your need for maximum cooling efficiency in little or no floor space at all!

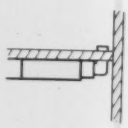
It is designed for free air discharge or use with a duct system . . . may be suspended overhead or positioned on the floor. *Waterless* operation assures quieter, thriftier operation—establishes a new concept of cooling performance. The complete refrigeration assembly is housed in a remote air-cooled unit that's engineered for comfort-cooling with outside air temperatures to 125° F.



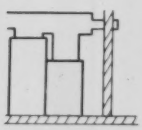
For your next residential or commercial job, provide controlled, high-efficiency cooling free from objectionable noise and drafts with the Janitrol Compack . . . one of Janitrol's complete line of conditioners for cooling and heating-cooling applications. Ask your Janitrol representative for full details.



Janitrol "Compack" in parallel with warm-air "up-flow" furnace completes a year 'round comfort system.

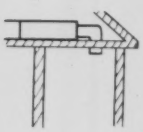


In basements with low headroom, "Compack" saves space—may be suspended from joists and utilize existing warm air ducts through a by-pass system.



Janitrol "Compack" blower coil unit with up-flow furnace in first floor closet or utility room.

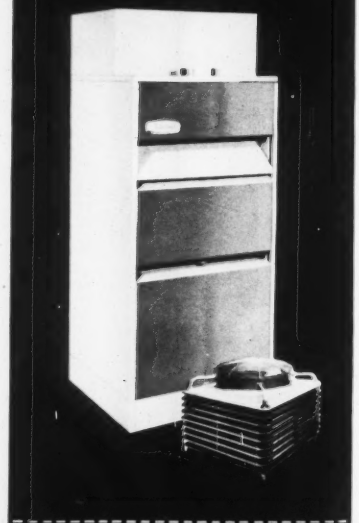
"Compack" installed overhead in an office. Whisper-quiet, it never intrudes to disturb busy people.

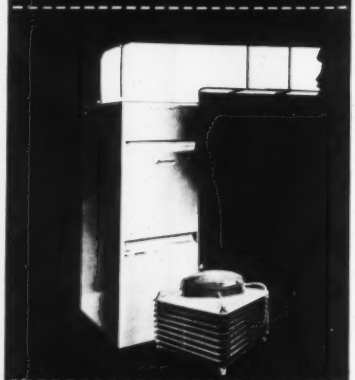


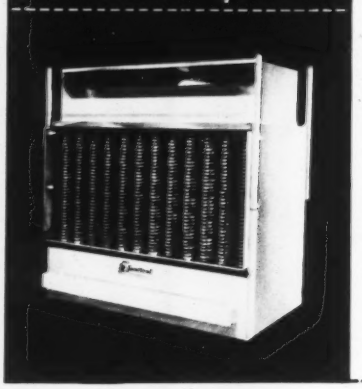
Janitrol "Compack" in attic—cools entire house through small ducts feeding diffusers near ceiling of rooms below.

"Compack" feeding a duct system in modern store. Several "Compack" units can be combined to meet a variety of cooling needs—provide zone control where desired.

"Compack" installed upright on the floor in restaurant. Draftless, free-air discharge.







WIN-SUM-MATIC

Year 'round conditioner

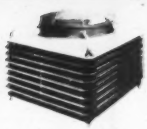
Combines thrifty gas heating, waterless cooling in little as 3-3/5 sq. ft. of floor space. Famous 20 year warranted Dura-Tube heat exchangers. Unique by-pass gives correct air flow for heating and cooling without seasonal adjustments. Air cooled Pride O' Yard unit is low, sleek, efficient . . . ADD-ON cooling option—install for heating only, add cooling later. Upflow and downflow models, 80,000 to 200,000 btu./hr. (to 120,000 on down flow) heating, 22,000 to 76,000 btu./hr. cooling capacities*.

SRA add-on cooling

Adapts most any warm air furnace for thrifty, efficient central cooling. Cooling coil mounts in duct, beautiful air cooled Pride O' Yard unit goes outside. Powerful, quiet performance with outside temperatures to 125° F. Easy to install. Waterless operation eliminates plumbing, sewage, water supply problems. 22,000 to 76,000 btu./hr. Capacities*.

Gas-fired Duct furnaces

Designed for installation in a duct where the air is circulated by a separate blower. Especially adaptable for industrial heating applications in combination with cooling. DUCT Series 55 in five sizes from 85,000 to 225,000 btu./hr. Series 75 in sizes 200,000 and 300,000 btu./hr. may be combined to provide unlimited capacity range.



CAPACITIES*

SRA-7—22,000 btu.
SRA-9—35,000 btu.
A-401 and 403—47,500 btu.
SRA-11—58,500 btu.
A-603—76,000 btu.

*95° F. Dry Bulb air entering condenser, 80° F. Dry Bulb, 67° F. Wet Bulb air entering evaporator, approximately 400 CFM per 12,000 btu.

ARCHITECTS, ENGINEERS AND CONTRACTORS INFORMATION SERVICE

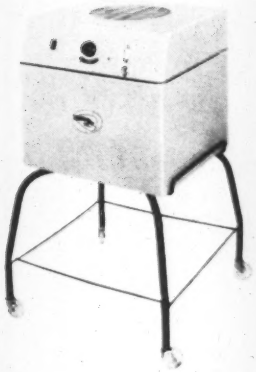
Write today for complete specifications on Janitrol cooling and heating in buildings of every type. There's no obligation.

Surface Combustion Corporation • Columbus 16, Ohio

In Canada: / Moffat Heating & Air Conditioning Division Moffats Ltd., Toronto 15

Also Makers of Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment

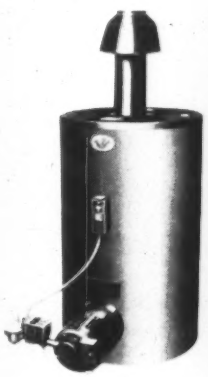
EQUIPMENT DEVELOPMENTS
Continued



Electronic Air Cleaner . . .

. . . in portable design with two-speed motorized fan, requiring no water or drain connection. *Electro-Air Cleaner Co., Inc., Dept. HPAC, Olivia and Sproul Sts., McKees Rocks, Pa.*

"Room Size" electronic air cleaner handles 225 cfm at 90 percent efficiency, according to manufacturer. Particles down to 1/100 micron are removed from air passing through unit.



Water Heater . . .

. . . designed for volume water heating. *Portmar Water Heater Co., Inc., Dept. HPAC, 193 Seventh St., Brooklyn 15.*

"DG Series" direct, gas-fired, commercial water heater automatically supplies quantities of rust-free hot water for commercial and industrial use. Galvanized inside and outside, heater is equipped with anode rod for added protection against corrosion. Available in four sizes: 135, 187, 235, 300 gph with 100 F rise.

ST. LUKE'S HOSPITAL
Bethlehem, Pennsylvania

Increased patient comfort, summer and winter, will be provided by this KoolShade installation (shown here in progress). KoolShade Sunscreen intercepts solar heat and glare before it reaches the glass.

Architects: Crow, Lewis and Wick, New York, N. Y.
KoolShade Distributor: Homestead Aluminum Window Co.

Beat solar heat and glare ...the modern KOOLSHADE way

• The *original* solar screening, KoolShade Sunscreen provides the most effective method known for shading windows against solar heat and glare. Here are 8 big reasons why:

① **Keeps interiors cooler.** By screening out up to 89% of the sun's hot rays, KoolShade keeps interiors 15% cooler and more.

② **Saves on air conditioning.** By reducing solar load, KoolShade minimizes initial tonnage requirements ...cuts operating costs. (By rule of thumb, 100 sq. ft. of KoolShade reduces cooling load by approximately 1 ton.)

③ **Reduces solar glare.** Widely used as a daylighting aid, KoolShade moderates sun and sky glare. Screens out direct solar rays to improve lighting balance, guards against eye-strain.

④ **Gives full outward visibility.** Because it's woven (not stamped), KoolShade permits up to 83% clear outward visibility...greater view by far than *any* comparable shading device.

⑤ **Enhances building appearance.** In harmony with all architecture, KoolShade introduces sleek uniformity to all visual openings.

⑥ **Virtually no maintenance.** Because it can't rot, rust or corrode, KoolShade upkeep is negligible. Nubelon-coated, too, for utmost weather resistance.

⑦ **New written warranty!** With KoolShade Sunscreen and Kool-Frame Extrusions you now get a written warranty of quality.

⑧ **Franchised installation.** For maximum satisfaction and performance, KoolShade is sold and installed only by Franchised, factory-trained distributors.

SEND TODAY for this free illustrated bulletin. Find out how you, too, can solve your solar problems with modern KoolShade. No cost or obligation.

KOOLSHADE® SUNSCREEN

REFLECTAL CORPORATION
A subsidiary of Borg-Warner Corp.
200 S. Michigan Ave., Dept. K-57,
Chicago 4, Illinois.

Without obligation, please send us:
☐ Free Literature
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Name ..... Title .....
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City ..... Zone ..... State .....

THE MARK OF QUALITY

BARBER COLMAN

Automatic Controls

Accurate eye-level remote temperature indication

. . . no limit to the number of points monitored by a single instrument

Temperatures anywhere in a building can be read on a single, centrally located Barber-Colman indicator wired to remotely located sensing elements. Time-consuming trips to check temperatures at remote points are eliminated completely.

The system is extremely simple and completely reliable. Barber-Colman remote electronic sensing elements consist of a coil of temperature-sensitive wire. There are no moving parts, nothing to get out of order. Current flow through the sensing element changes as the temperature changes.

Pushing a button for the area to be checked closes the circuit between the sensing element and the indicator, unbalancing a bridge circuit which actuates the pointer.

A mirrored scale assures accurate readings even when the operator is standing at an angle to the instrument.

Extreme accuracy is assured. Temperature readings are not affected by normal line voltage fluctuations.

Temperature indication is independent of control elements. Malfunction of the control sensing element cannot cause an incorrect temperature reading.

For use with all types of control systems. May be added to an existing installation or incorporated into a new system, with or without remote control point adjustment.

For complete information and literature, call your local Barber-Colman Automatic Controls office or write.

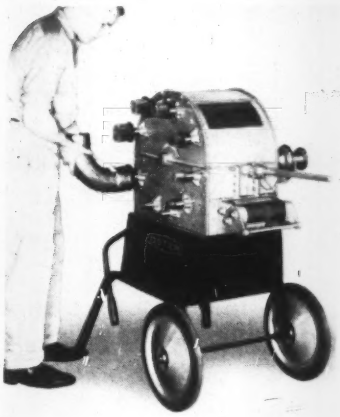
"Better Control . . . Electrically"

BARBER-COLMAN COMPANY

Dept. T, 1301 Rock Street, Rockford, Illinois

EQUIPMENT DEVELOPMENTS

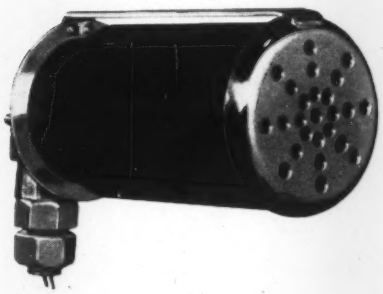
Continued



Fitting, Tube Cleaning Machine . . .

. . . designed to combine all operations necessary in preparing and cleaning copper fittings and tubing for soldering—*Oster Mfg. Co., Dept. HPAC, 1340 E. 289th St., Wickliffe, Ohio.*

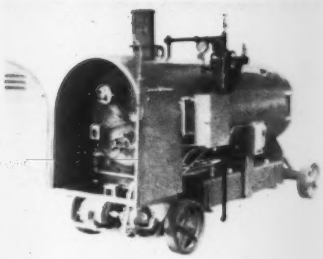
Copper tube cleaning machine cleans inside of fittings, outside of tubing, cuts off, deburrs, reams tubing. Unit handles all sizes from $\frac{1}{2}$ to 4 in.



Low-Level Warning Switch . . .

. . . designed to be unaffected by contaminants in fluid—*Acme Machine Works, Divac Div., Dept. HPAC, 13025 Cerise, Hawthorne, Calif.*

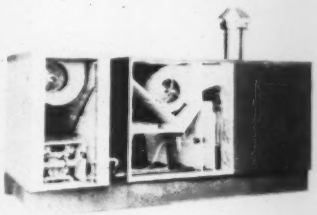
Explosionproof, hermetically sealed, low-level warning switch can be installed with warning lights and/or automatic switching mechanisms to start pumps or open auxiliary lines. Operates at temperatures from −65 to 250 F on any electrical system from flashlight battery to 300 volts at 5 amp.



Portable Boiler . . .

. . . designed for steam cleaning or thawing—*Cleaver-Brooks Co., Dept. HPAC, 326 E. Keefe Ave., Milwaukee 12.*

"Monitor" portable boilers available in 10, 50 hp sizes. Units measure 15 ft long, 4 ft wide, and $5\frac{1}{2}$ ft high; weigh 5000 lb each. Mounted on frame with hard rubber wheels. Smaller 10 hp unit has output of 1380 lb of steam per hr at 212 F; 50 hp boiler delivers 1725 lb of steam per hr at 212 F.



Air Conditioning Units . . .

. . . designed for installation in single-story buildings—*Ventil-Aire Corp., Dept. HPAC, 1815 Decatur St., Ridgewood 27, N. Y.*

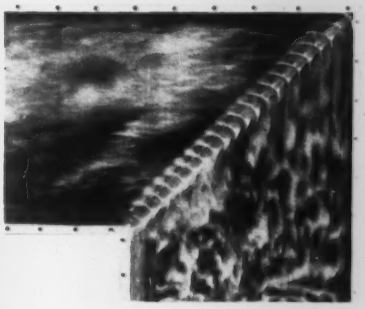
Packaged air conditioning units completely built in sizes of 5, $7\frac{1}{2}$, 10, 15 tons, for heating and cooling, and either gas or oil fired. Cabinets are constructed of 16 gage galvanized steel, bonderized and painted.

Fluid Flow Meter . . .

. . . designed to measure air conditioning, heating and power plant variables, provide digital encoding for remote reading of flow, liquid level, pressure, or temperature—*American Meter Co., Mechanical Components, Dept. HPAC, P. O. Box 309, Garland, Texas.*

"Series 400" digital transducers

How Barber-Colman Airturns pay off

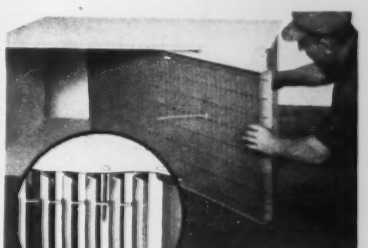


You can save space and money by using Barber-Colman Airturns to guide air around corners in duct systems.

They minimize pressure losses, too. Extensive laboratory and field studies show that pressure drops in square elbows with Airturns are less than 20% of the velocity head. This equals the performance of space-consuming, long-radius elbows without vanes. It is superior to the performance of any other factory-made units available. It is two to four times better than the performance of contractor-fabricated vanes studied.

Cost is in favor of Airturns. Installation is less than that of long-radius elbows. Factory mass production results in modest initial cost. And, the cost of call-backs often is reduced by improved system performance.

When you add up all the benefits, Barber-Colman Airturns pay off well. They are available cut to size, ready to install, or in 48″ x 48″ slabs.



For complete details, call your local Barber-Colman Air Distribution field office, or write for literature.

BARBER COLMAN

Uni-Flo

ENGINEERED AIR DISTRIBUTION

BARBER-COLMAN COMPANY

Dept. T, 1101 Rock Street, Rockford, Illinois

THE MARK OF QUALITY

BARBER COLMAN

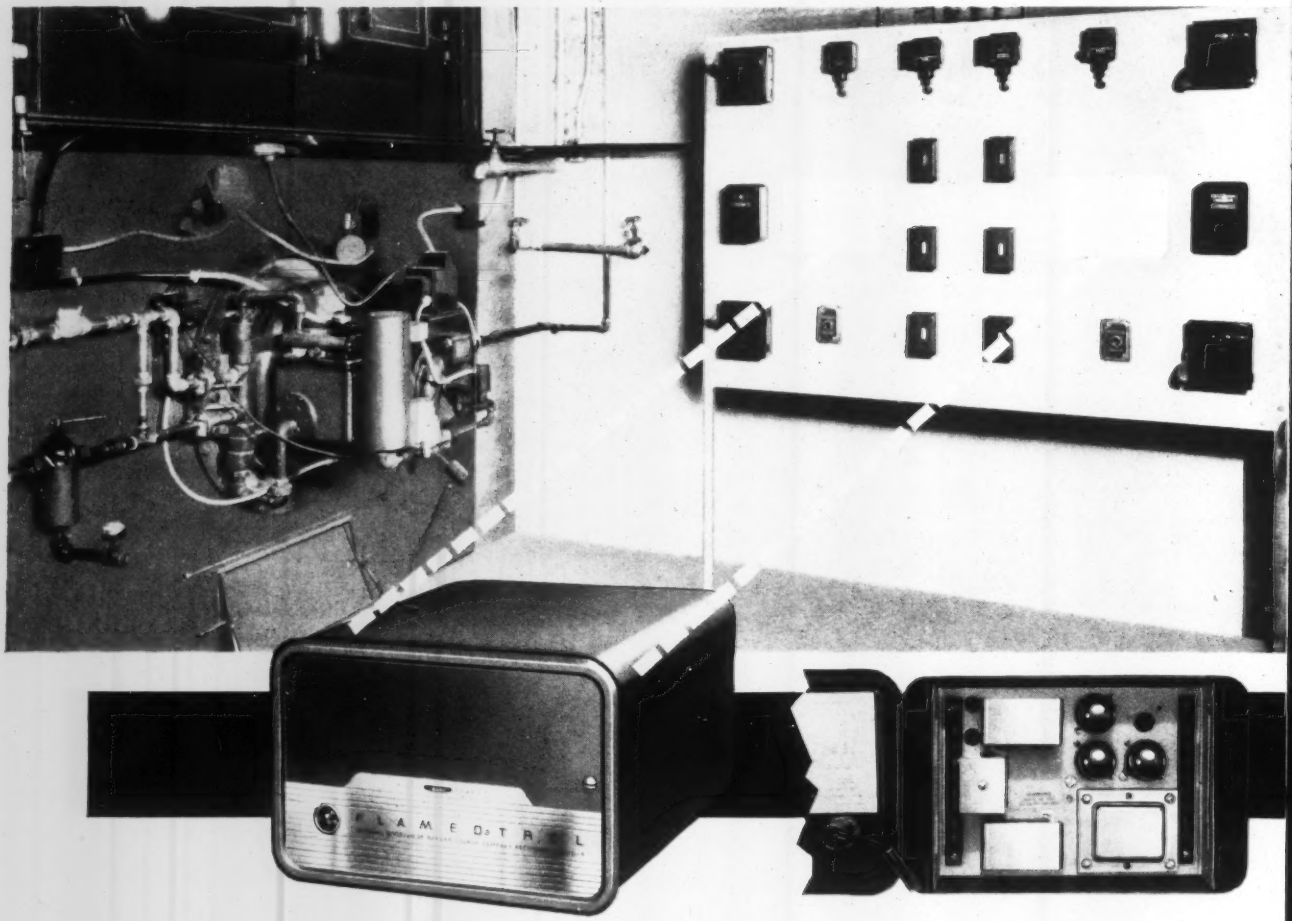
Wheelco Instruments

Look for all these features when choosing combustion safeguards

1. Ability to choose the best system for your needs from a complete line

2. Modern equipment designs to insure long trouble-free life, simple inspection and maintenance

3. Equipment backed up by a nationwide, thoroughly trained field organization



Pushbutton-start Flame-otrols, like the one shown here, are available with a Series 1470 Conductivity-Rectification system or a Series 1570 Infra-Red system.

Convenient external test points for checking circuits and voltages with conventional test instruments. Electronic tubes are standard types simplifying replacement.

write for literature describing Wheelco Flame-otrols

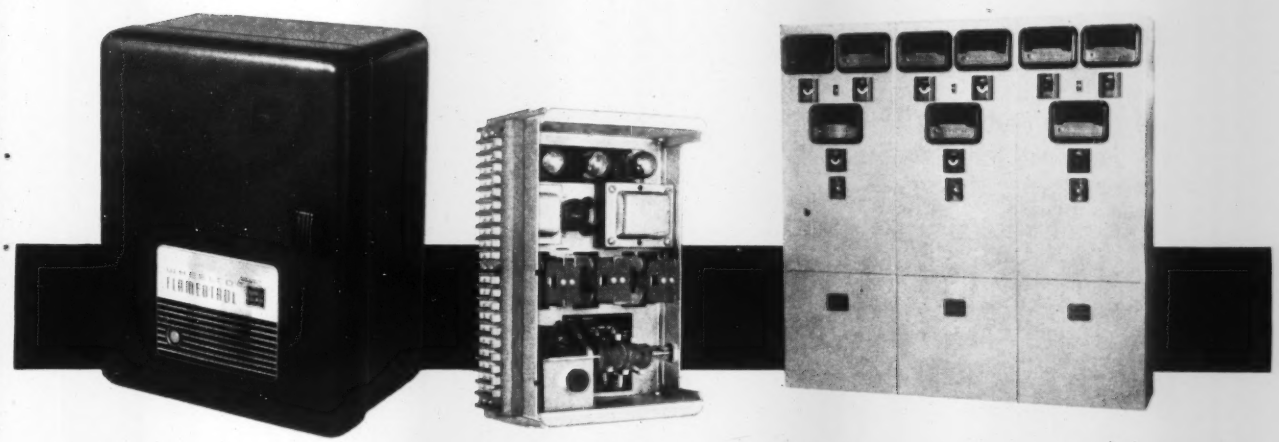
Unless your combustion safeguard system provides all these features you may be making an expensive and needless sacrifice. Wheelco Flame-otrols meet all these requirements whether the application be on a boiler, furnace, kiln, or dryer, and provide them at the cost of conventional equipment.

One Is Best — Wheelco offers two automatic operation and two pushbutton-start Flame-otrols to provide the exact system and the degree of control needed for a particular installation. Either Conductivity-Rectification "CR" systems or Infra-Red "IR" systems are used to monitor the flame. IR systems use a lead sulphide photoconductive cell as the sensing element, while CR systems use flame rods and emissive-type photo cells.

Easy Maintenance — With Wheelco's justly famous plug-in design, inspection and maintenance are easier and faster. The entire chassis may be removed for examination, adjustment, or repair. Standard electronic tubes are used throughout simplifying replacement from local stocks and cutting inventory needs. Wheelco's practical design permits Flame-otrols to be installed in every type of plant location by housing them in rugged, industrial-type steel cabinets provided with a gasketed, dust-tight, swing-out cover.

Control Centers Too — Custom-engineered installations that house a complete combustion safeguard system including Flame-otrols, pilot lights, alarms, etc., have long been a Wheelco specialty. These attractive centralized packages reduce installation costs and time, yet are provided with removable sections that offer flexibility for changing requirements.

Field Engineering Help — It pays to bring the Wheelco field engineer in on your planning when combustion safeguards are needed for a new or modernized installation. His experience plus the availability of a full line of instruments is your assurance of getting the system best suited to your needs. Wheelco field engineers are located in all principal cities, are as close to you as your telephone. This nationwide network, plus specialists in the home office, is always available to help you with your problems.



External and internal views of super-duty automatic Flame-otrols. Programing of these units includes purging, warm-up proving, pilot proving, low-fire stabilization, ignition timing and post-purging.

Custom-engineered Wheelco control centers can incorporate a wide variety of features. Either pushbutton-start or automatic Flame-otrols can be provided.

BARBER-COLMAN COMPANY

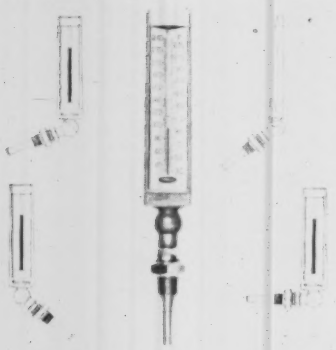
Dept. T, 1501 Rock Street, Rockford, Illinois, U.S.A.
BARBER-COLMAN of CANADA, Ltd., Dept. L, Toronto

Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Electrical Components
Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

EQUIPMENT DEVELOPMENTS

Continued

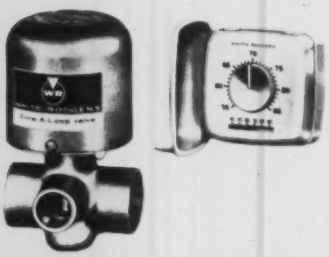
available in vacuum and pressure ranges to 10,000 psi; temperature ranges to 600 F, and in mercury or bellows type manometers for liquid level or flow applications. Manufacturer's bulletins available describe product in detail.



Industrial Thermometer

. . . for adjustment to any viewing angle *Precision Thermometer & Instrument Co., Dept. HPAC,* 1434 *Brandywine St., Philadelphia* 30.

Locking device allows reset to desired position should thermometer be moved to new location or repositioned due to change in piping. Tube recessed between two piece scale to eliminate parallax, while red reading mercury tubing seen against baked white enamel scale. Unit available with exposed bulb and perforated stem construction for air conditioning, heating applications.



Control Package . . .

. . . for hot water heating systems—*White-Rodgers Co., Dept. HPAC,* 1209 *Cass Ave., St. Louis* 6.

"Zone-A-Loop" control package provides each zone with low-voltage thermostat and small automatic rotary water valve which allows unrestricted flow through main when thermostat calls for heat.

Water Hammer Eliminator

. . . designed to provide efficient method of controlling hydrostatic shock and eliminating water hammer on hot or cold water piping systems *Jay R. Smith Mfg. Co., Dept. HPAC,* 1119 *Morris Ave., Union, N. J.*

As shock occurs, stainless steel bellows of "Hydro-Trol" expand into pressurized expansion chamber which provides displacement required to absorb and control shock. Bellows surrounded by hydraulic fluid which, under shock pressure, forms hydraulic pressure cushion that holds bellows in alignment and prevents shock waves from bouncing, stabilizing water in line. Unit available in six sizes.

Iron Powder Electrodes . . .

. . . designed for increased deposition rate *Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy* 1, *Ohio.*

Electrode "12A" designed for welding mild steel in flat, vertical, and overhead positions on high speed production work. For use on d-c, straight polarity, but will also work on a-c. Available in 1/8 and 5/32 in. diam., in lengths 14 in.; 3/16 in. diam. in lengths 15 in.; 7/32, 1/4, and 5/16 in. diam. in 18 in. lengths.

Drill Anchor . . .

. . . developed to drill its own hole for anchorage with holding power to 17,860 lb—*Raulplug Co., Inc., Dept. HPAC,* 248 *Petersville Rd., New Rochelle, N. Y.*

Holes drilled in hard concrete, other masonry by drill-anchor's core action. Drill anchors may be used with power operated or hand hammers. Steel expander plug used in drill end with anchor for holding power.

Year 'Round Unit . . .

. . . developed for heating and cooling applications—*Service Engineering & Refrigeration, Div. of Ventil-Aire Metal Fabricating Corp., Dept. HPAC,* 1815 *Decatur St., Ridgewood* 27, *N. Y.*

Roof mounted, self-contained air conditioning unit has remote acting thermostat that controls both heating cooling cycles. Units available in 5, 7½ and 10 ton capacities. Units also have 4-row heavy duty cooling coils.

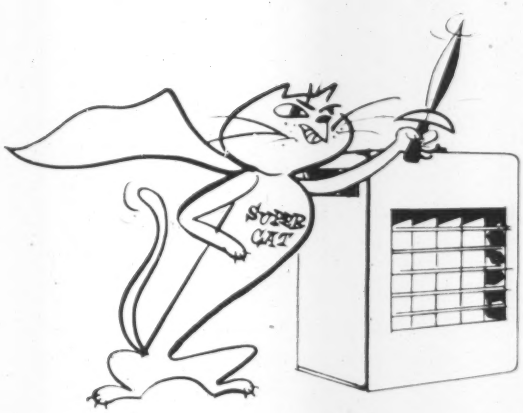
Corrosion Inhibitor . . .

. . . for protection of steel, but copper, brass, aluminum, solder, other metals—*Hagan Chemicals & Controls, Inc., Dept. HPAC, Route* 60 *at Campbell Run Road, P. O. Box* 1346, *Pittsburgh* 30.

Nonchromate inhibitor "CS" recommended by manufacturer for corrosion inhibiting applications in closed recirculating water systems, such as air conditioning systems, process cooling water systems, hot water boilers, etc.

kitten quiet...

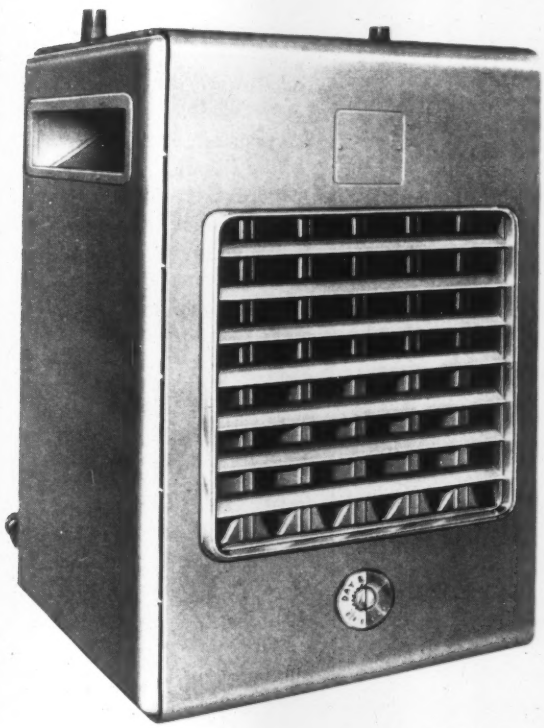
easiest to keep clean...



...and the

heat exchanger is

PROTECTED BY *Jetglas* -C



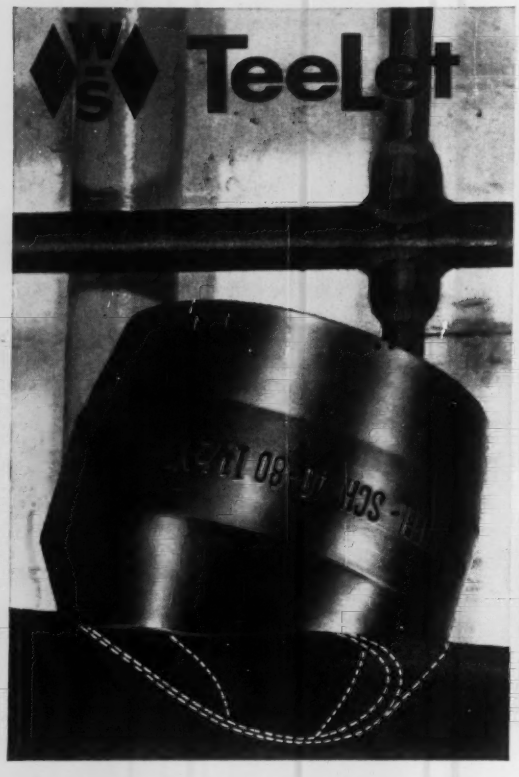
DAY & NIGHT UNIT HEATER

Missile nose-cone durability has given birth to important by-products like **Jetglas-C,** the miracle protection for heat exchangers on Day & Night unit heaters. Can't burn out, can't rust out, can't wear out! Add that to design advantages that provide for easy installation, easy cleaning and maintenance, super-quiet and efficient operation—and you have the finest unit heater on the market today. For complete information, write to:

DAY & NIGHT MANUFACTURING CO.

855 Anaheim-Puente Rd. • La Puente, Calif.

FOR ⅛ TO 1½ INCH BRANCH CONNECTIONS



MARK

CUT

WELD

NEW W-S TeeLet SLASHES TEE COSTS 50% OR MORE!

The new W-S TeeLet replaces conventional Tees of cast or malleable iron, welded or forged steel . . . requires fewer stock sizes. Available in sizes from ⅛ to 1½" IPS, TeeLets are fully machined from forging quality solid steel bars and adapt to run-pipe sizes to 36". They require no additional joint strength calculations for any ASTM A-53 or A-106 Grade B run-pipe of Schedule 40 or 80.

What about cost? A size-by-size comparison with conventional Tees shows TeeLets average less than 50 per cent of the cost you now pay. A W-S TeeLet, with screwed, socket-weld or butt-weld ends, requires no shaping, fitting, beveling or extra alignment. You can connect to the run-pipe at any point. Short heights mean easy inspection of the attachment weld or back-weld, if desired.

A W-S TeeLet costs less to buy, less to install than anything you can buy or make. For complete information, prices, and names of distributors, write: *Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.*

FORGE AND PORTER ***FITTINGS DIVISION***

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products: "THERMOID DIVISION. Electrical Equipment: DELTA-STAR ELECTRIC DIVISION. NATIONAL ELECTRIC DIVISION. Copper and Alloys: RIVERSIDE-ALLOY METAL DIVISION. Refractories: REFRACTORIES DIVISION. Electric Furnace Steel: CONNORS STEEL DIVISION. VULCAN-KIDD STEEL DIVISION. Fabricated Products: DISSTON DIVISION. FORGE AND FITTINGS DIVISION. LESCHEN WIRE ROPE DIVISION. MOULDINGS DIVISION. H. K. PORTER COMPANY de MEXICO, S. A., and in Canada, Refractories: "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems: H. K. PORTER COMPANY (CANADA) LTD.

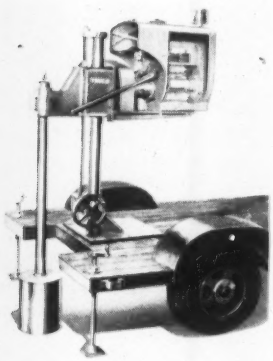
EQUIPMENT DEVELOPMENTS

Continued

Pipe Insulation . . .

. . . designed to eliminate condensation drip of cold water pipes during humid seasons—*Zippertubing Co., Dept. HPAC, 752 S. San Pedro St., Los Angeles.*

"Anti-Drip" covers never become moldy, says manufacturer; condensation said not to occur because pipe surface is not exposed to air. Available in sizes to fit ¾ and 1 in. pipe; other sizes also provided.



Indicating Controllers . . .

. . . developed to indicate and/or control any variable heat that can be converted into electrical quantity—*Thermo Electric Co., Dept. HPAC, Saddle Brook, N. J.*

Indicating controller has new high-gain servo-amplifier designed to provide high sensitivity, stability, maintain operating characteristics under adverse conditions. Amplifier's stability is ±1 microvolt. Sensitivity is 1 microvolt, power gain in 135 decibels; voltage gain is 100 million at rated load.

Pipe Hole Cutter . . .

. . . attaches to acetylene torch for cutting holes in thick metal plate—*Ideas, Inc., Dept. HPAC, 214 Irvinson Ave., Laramie, Wyo.*

"Or-O-Co" unit cuts circular holes and solid discs ½ to over 12 in. in diam. Squares, rectangles, odd shapes can also be formed. Applications include welding fabrication pipe hole cutting, etc.

"FOR QUALITY, ECONOMY AND SERVICE, I'LL PICK SPANG STEEL PIPE EVERY TIME"

says Mr. Anthony A. Madonna, Owner of Twin Arc Welding Company, Lancaster, Pennsylvania

"I know from experience that when I use SPANG Steel Pipe I'm getting a top-quality product," states Mr. Madonna. "Another thing, on the $206,000 heating contract for the Conestoga Valley High School, SPANG'S Distributor—Raub Supply Co. of Lancaster, Pa.—made sure we had all the pipe at the job site before construction began. That's the kind of service I like—fast, reliable, economical."

HELPS SAVE INSTALLATION TIME

Because his reputation rides on every job, Mr. Madonna must be absolutely sure the materials he uses are good. With SPANG Steel Pipe, for instance, he knows he can count on clean, tight welds and true end cuts. And the pipe interior is free of dirt and scale. That means no lost time for inspection and maintenance.

GET TOP-QUALITY PRODUCTS AND SERVICE WITH SPANG

SPANG Steel Pipe is manufactured under strict *quality-controlled* methods and inspected to insure you of efficient, long-lasting service. For your next job, get results like these; make it steel pipe . . . make it SPANG.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
Two Gateway Center
Pittsburgh, Pa.

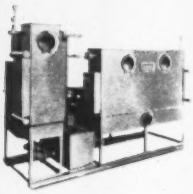
SPANG®
CW STEEL PIPE

"Sure, I'll tell you why I choose SPANG Steel Pipe," reports Mr. Madonna. "With SPANG I know I'm getting top-quality. I always receive good service from the SPANG Distributor; and SPANG Steel Pipe does the job more economically in the long run."

Heating and Ventilating Contractor:
Twin Arc Welding Company, Lancaster, Pa.
SPANG Distributor:
Raub Supply Company, Lancaster, Pa.

KATHABAR® SYSTEMS

Give these advantages to specifying engineers:



STERILE AIR

Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to deliver air at 5 micro-organisms per 10 cu. ft. or less, continuously.

FROST-FREE COOLING

Get continuous air supply at dry bulbs and dew points way down to −90 F. No freeze-ups... no fluctuating efficiency... no defrosting shutdowns... no duplicate sets of coils. Cool better; fewer tons. Proved in candy cooling... photo film chilling... brewing... chemical processing... environmental testing... many other applications.

GET FACTS

SURFACE COMBUSTION CORPORATION
2384 Dorr Street, Toledo 1, Ohio

Send facts on Kathabar systems for following application:

.....

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name & title.....
company.....
street.....
city.....*zone*.....*state*.....

Surface

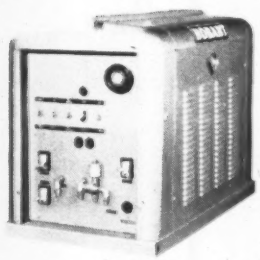
59-2E

EQUIPMENT DEVELOPMENTS
Continued

Control Valve . . .

. . . developed for use with air, oil, gas, water or other fluids—*Manatrol Corp., Dept. HPAC, 2103 Payne Ave., Cleveland 14.*

"Colorflow" control valve has adjusting scale composed of color graduations. Color coding of valve said to facilitate operation even for untrained personnel. Available in five standard sizes: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ in. for pressures to 5000 psi. Internal, moving parts of stainless steel; valve bodies in brass, carbon steel, stainless steel.

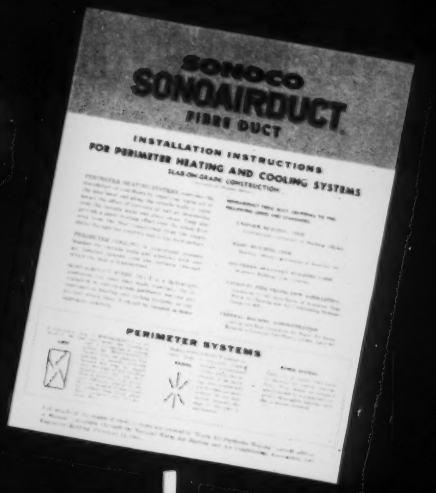


Inert Gas Welder . . .

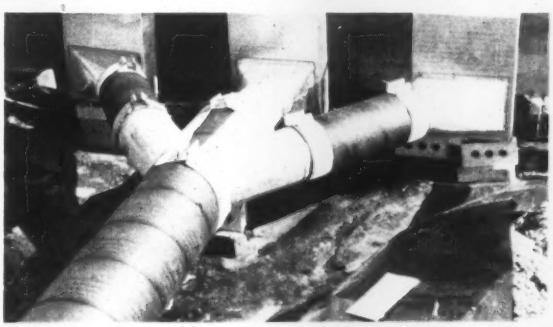
. . . in package unit for remote, tungsten-inert-gas shielded arc welding—*Hobart Brothers Co., Dept. HPAC, Hobart Sq., Troy 1, Ohio.*

Portable "Tigpak" welding unit designed to eliminate need for moving arc welding equipment and extending water lines for remote welding jobs. Unit has a-c/a-c gasoline engine driven welders of 200 or 300 amp capacity. Can be used with d-c gas driven welders provided source of 110 volt a-c power is available; also with electric powered d-c, a-c or a-c/d-c motor-generator sets.

Send for this new, helpful fibre duct installation manual...



Taylor University, Upland, Ind.; Oris Eash, Fort Wayne, Ind., architect.



St. Paul's Lutheran Church, Dallas, Texas; Stone Company, sub-contractor, Dallas.

New SONOAIRDUCT Fibre Duct installation manual is now available! This helpful manual contains latest, detailed step-by-step installation data. Use your company letterhead to send us your name and address for a free copy.

SONOCO SONOAIRDUCT® FIBRE DUCT

is America's best selling fibre duct!

For years, Sonoco SONOAIRDUCT — the original fibre duct — has been America's most popular product of its type with builders and contractors. It is made especially for slab perimeter heating or combination heating and cooling systems. Initial cost is low. Installs fast. Available in 23 sizes — 2" to 36" I.D., in standard shipping lengths of 18'. Special sizes, to order. Meets and exceeds F.H.A. criteria and test requirements for products in this category. See our catalog in Sweet's.

For complete information and prices, write—

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SONOCO

Construction Products

SONOCO PRODUCTS COMPANY

IN HOT WATER HEATING WHY STOP AT

No matter what your requirements . . . 180° F. . . . 220° F. . . . 250° F. . . . 300° F. . . . 350° F. . . . 430° F., International-LaMont THERMOJET® Hot Water Generators are your key to truly significant savings in modern hot water heating systems.

HIGHER TEMPERATURE DROPS MEAN GREATER ECONOMY

These forced recirculation water tube Generators extract *more* heat from *less* water. By merely increasing the temperature differential between boiler outlet and return water from the "conventional" 20° F. to 80° F., water flow rates are cut 75%. Lower flow rates mean reduced pipe and pump sizes, with attendant savings throughout the system. With International-LaMont THERMOJET® Generators, temperature differentials up to 200° F. are in use and are recommended, effecting even greater savings.

Positive, high velocity boiler water circulation assures peak heat absorption rates—far beyond those obtainable with natural circulation boilers, plus instant response to changing load demands. Any danger of thermal shock is eliminated.

Set your own temperature limits from 180° F. to 430° F., but project your thinking in terms of the unmatched capabilities of International-LaMont THERMOJET® Generators . . . specifically designed for the modern concept in hot water heating.

Get full details from your **INTERNATIONAL DISTRICT REPRESENTATIVE** or write for Bulletin 1000 today.

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THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

810 Spruce St. East Stroudsburg, Pa.

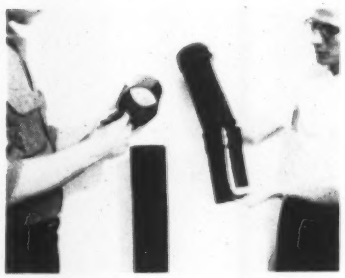
Manufactured and sold in Canada under agreement with CANADIAN VICKERS LTD. Montreal, P. Q.

EQUIPMENT DEVELOPMENTS *Continued*

Gas Welding Outfit . . .

. . . developed to weld steel up to $\frac{3}{8}$ in. thick, cut up to 1 in. steel plate—*Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 150 E. 42nd St., New York 17.*

"Aircomite" gas welding outfit includes one oxygen and one acetylene regulator, one welding torch with three tips, one cutting attachment and tip, one pressure mixer with gas sealing rings, and other accessories. Oxygen regulator equipped with 60 psi and 1000 psi high pressure gage. On acetylene regulator, a 30 psi and a 100 psi gage are used.



Polyethylene Pipe . . .

. . . with hubbing as integral part of pipe designed to eliminate need for separate coupling—*Koppers Co., Inc., Plastics Div., Dept. HPAC, Koppers Bldg., Pittsburgh 19.*

"Pi-Mar D" drainpipe is made of high-density polyethylene, can be cut with handsaw, and requires no special tapering tools, no adhesives in installation. Pipe impervious to waste acids, alkalis, will not rot, rust, or corrode, and will not fracture when abused, according to manufacturer. Crushing strength of pipe is over 300 lb. Available in diameters of 2, 3, 4 in.; produced in 20 ft or special lengths, if desired.

Architect: Kenneth Franzheim and Associates, Houston

General Contractor: W. S. Bellows Construction Corporation, Houston

Engineer: Dale S. Cooper and Associates, Houston

Heating and Air Conditioning: Barber, Inc., Houston

Heating and Air Conditioning with

USS National Pipe—

Houston Office
The Prudential Insurance Company of America

A prominent fixture on the Houston sky line is the massive 21-story Houston Office of The Prudential Insurance Company of America. Within this modern structure, Prudential employees enjoy the year-round comfort of a heating and air-conditioning system served by 120 tons of USS National Seamless Pipe in sizes 4" O.D. through 16" O.D.

This is the second of Prudential's efficient new office buildings to rely on National Pipe. The 41-story Prudential building in Chicago used about 200 tons of National Pipe in its air-conditioning, heating and plumbing systems.

Do you need quality pipe for air-conditioning, heating and power installations? Seamless or butt-welded pipe that will pay you back in outstanding service a hundred times over for every dollar you spend for it? Then be sure to say "NATIONAL PIPE." If you'd like further information or immediate assistance with your pipe problems, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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National Tube Division of USS United States Steel

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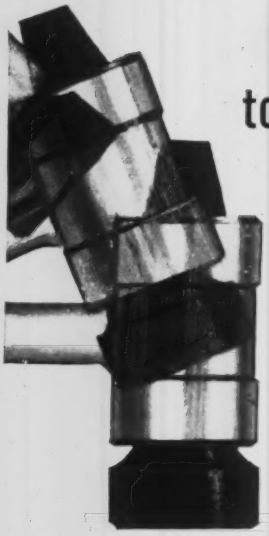
COUNT ON SHURE-SET



the "power-concentration" tool that revolutionizes light fastening!

With Shure-Set's unique "Power Transfer" design, you can drive pins and threaded studs right through light-gauge metal into concrete with a few strokes of a hammer. The hammer-driven Shure-Set light fastening system is ideal for carpenters, plumbers, electricians, builders, and maintenance personnel for quick, reliable fastening into steel, concrete, or building block... no drilling or cartridge required.

Shure-Set supports the fastener until it is driven home . . . no duds, no bent studs or pins, no smashed thumbs. Try Shure-Set and you'll save time, money, and temper while doing a better job. Look for your Shure-Set dealer under "tools" in the yellow pages.

In addition to hammer-in Shure-Set, the versatile Ramset Fastening System includes Ramset powder-actuated method for heavier fastening, and Ringblaster® heavy-duty kiln gun.

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Ramset Fastening System

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12109-H BEREA ROAD · CLEVELAND 11, OHIO

EQUIPMENT DEVELOPMENTS
Continued

Oil Line Heater . . .

. . . developed to provide low heat for oil in exposed fuel lines on burners where oil becomes congealed, solidified during shutdown—*Vulcan Electric Co., Dept. HPAC, 83 Holten St., Danvers, Mass.*

"Miniwatt" heater is 2 in. in overall size, including nut. Unit rated at 40 watts, 230 volt, is provided with $\frac{1}{4}$ in. NPT screw bushing and 24 in. flexible metal covered leads. Small bushing allows use of reducer to fit larger pipes.

Air Nozzles . . .

. . . developed to be used in accordance with standard test codes—*Rotherm Engineering Co., Inc., Dept. HPAC, 7280 W. Devon Ave., Chicago 31.*

Glass fiber air nozzles intended for applications measuring air volume. Units polished, calibrated before shipping. Mounting base sizes range 9 to 24 in.; throat diameters range from $1\frac{1}{4}$ to 10 in.

Temperature Control . . .

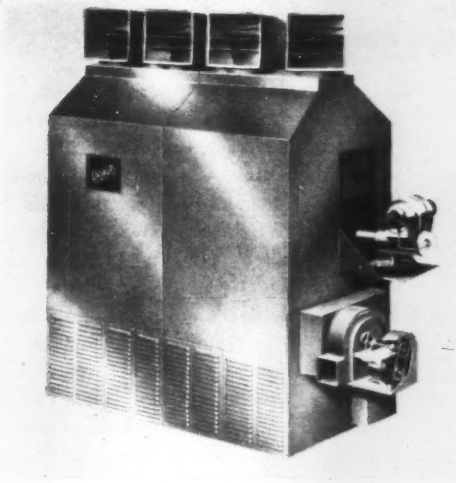
. . . providing setting and indication on single scale, with two pointers against dial face—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

"Type 65N" indicating temperature control available in models with capacities ranging from —100 to 450 F. Said to be suitable for applications where accuracy, small size are important factors.

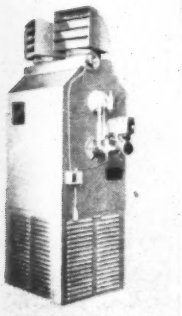
Diamond Drill . . .

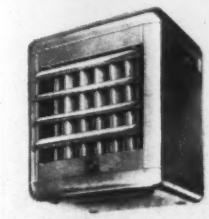
. . . for drilling of holes up to 20 in. OD through reinforced concrete, brick, marble, terrazzo, tile, etc.—*Truco Masonry Drilling Div., Wheel Trueing Co., Dept. HPAC, 3200-182 W. Davison, Detroit 38.*

"Model G" diamond drilling machine is portable, rolls on rubber-tired wheels. Unit available with electric motors of 5, 10, 15 hp, gasoline engines of $12\frac{1}{2}$ and 18 hp, and air motors of 5, 10, 15 hp.

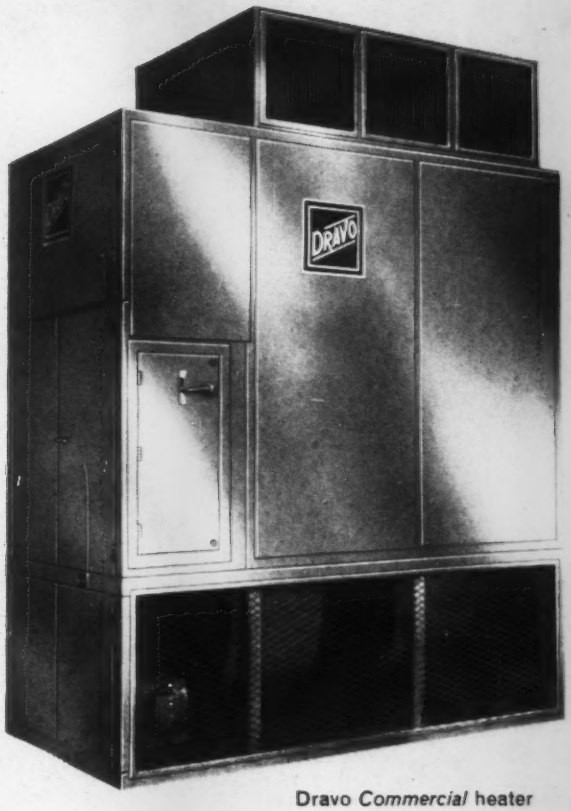


Dravo *Industrial* heater





Dravo *Paraflo* heater and *Suspended Unit* heater



Dravo *Commercial* heater

ONLY DRAVO HAS ALL 4

1. **FULL LINE**—A size and type for every heating need
2. **DESIGN AND APPLICATION KNOW-HOW**
3. **NATION-WIDE SERVICE**
4. **RESEARCH**

Dravo's full line of heaters is backed by a highly trained and extensive service organization, with a reputation for dependability and thoroughness.

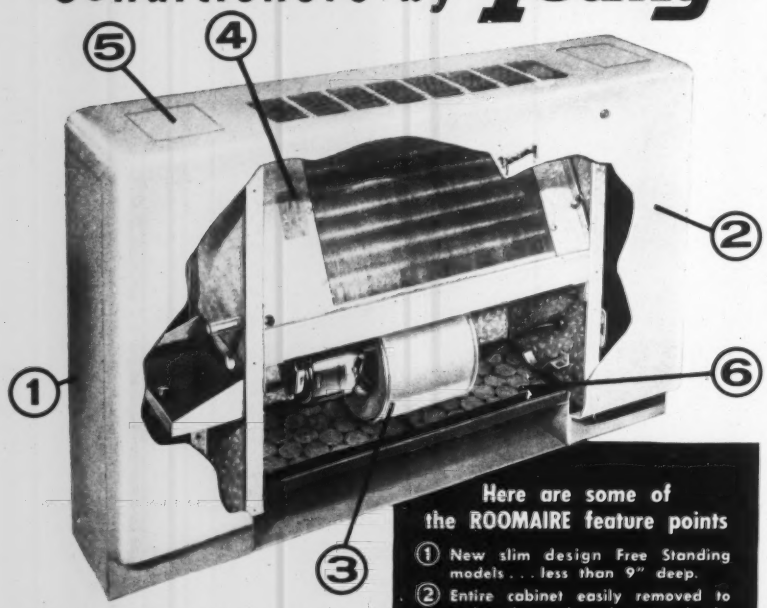
This is only one of the "extras" that benefit Dravo customers. The performance built into every Dravo heater is applied so that each installation functions with maximum efficiency. This is only possible because *every* Dravo technical representative *is a qualified heating engineer.*

Complete research and laboratory facilities conduct continuous studies of heater design problems. With the experience gained from over 10,000 installations, these studies result in basic improvements in all phases of both heater engineering and its application to unusual heating problems.

Make sure you get "ALL 4" when you are buying space heating. Only Dravo has the manpower, the technical background, and the facilities to assure your getting the most for your money. Write Dravo Corporation, Pittsburgh 22, Pennsylvania.

DRAVO
CORPORATION

NEW THIN Remote Roomaire® Conditioners by Young



CHOOSE FROM 16 UNITS . . . 4 MODELS IN 4 SIZES

When you specify Remote Roomaire Conditioners by Young, you are providing year 'round comfort for individual rooms of multi-room installations. Both beauty and performance are combined in a quality unit by engineers known for their continuing research in air conditioning, heating and cooling. Available in four types and sizes, individually controlled Roomaire conditioners are ideal for use in office buildings, hotels, apartments, schools, and homes.

Here are some of the ROOMAIRE feature points

1. New slim design Free Standing models . . . less than 9" deep.
2. Entire cabinet easily removed to make electrical and piping hook-up. After unit is completely installed cabinet can then be put in place.
3. Multi-blade fan circulates air quietly and evenly. Fan and motor assembly easily removed and replaced in minutes.
4. High capacity cooling or heating coil is slanted for proper air flow and condensation drainage.
5. Four-speed motor switch permits finger-tip control for the desired volume of properly conditioned air.
6. Air filter changeable without removing front or any part of cabinet.

TYPE F (Free Standing) —Cabinets are less than 9" deep and only 25" high. Unit is very accessible for maintenance.

TYPE CF (Concealed Free Standing) — Designed for built-in installation directly below a window sill or back of a finished wall panel.

TYPE H (Horizontal) — Designed for exposed installation at ceiling.

TYPE CH (Concealed Horizontal) — For installation in a closet, or ceiling space.

For complete information see your nearest Young representative or write Young Radiator Co.

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Write Dept. 519-H for Catalog 7758

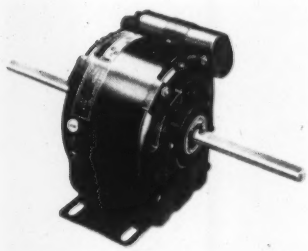
EQUIPMENT DEVELOPMENTS

Continued

Water Treatment . . .

. . . formulated to control microbiological growths in cooling towers and evaporative condensers for extended periods of time—*Calgon Co., Div. of Hagan Chemicals & Controls, Inc., Dept. HPAC, Route 60 at Campbell Run Road, P. O. Box 1346, Pittsburgh 30.*

"Biocide RP," new liquid inhibitor, is wide spectrum biocide intended to control many types of microorganisms, including algae, bacteria, fungi. Treatment lays down film over wood, metal surfaces, remaining active in system up to two months, according to manufacturer. Standard dose is 1 oz of biocide per 50 gal of water.



Replacement Motors . . .

. . . designed to replace air conditioning motors in units 1/3 through 2 hp. *Redmond Distributors Div. of Redmond Co., Inc., Dept. HPAC, Owosso, Mich.*

"Type CY" motor is permanent totally-enclosed split capacitor motor designed to provide higher starting torque, greater running efficiency. One motor can be used for two-speed or single-speed replacements.

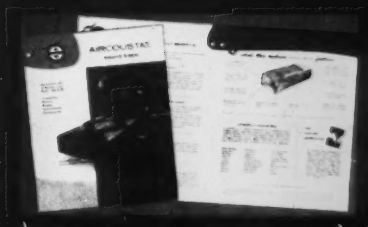
Air Powered Tool . . .

. . . developed for production, maintenance work requiring 3/8 in. nut *Ingersoll-Rand, Dept. HPAC, 11 Broadway, New York 4.*

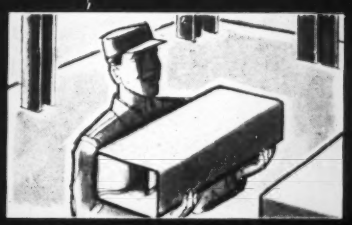
"Size 804 Impactool" made with steel hammer case, with steel hammer case bushing, and nylon composition, self-lubricating trigger. Tool runs with free speed of 6000 rpm at 90 psi air pressure, delivering 1200 impacts per min. Unit weights 5 7/8 lb.

7 ways AIRCOUSTAT®
can save you time and money

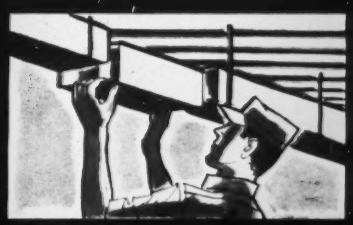
Sound Traps . . . with Guaranteed Results



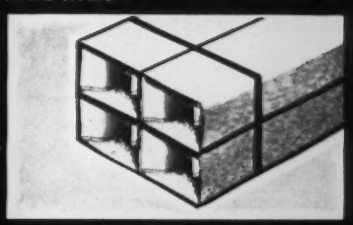
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



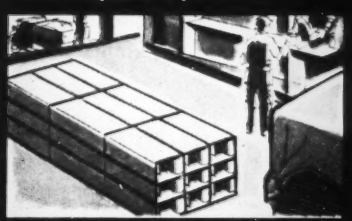
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



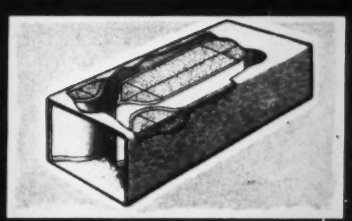
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



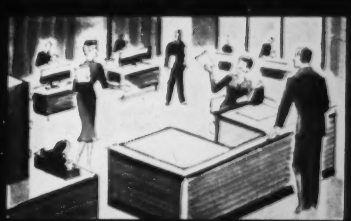
4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.



7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3408 Scott Street, Baltimore 3, Maryland.

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SOUND CONTROL

METAL PRODUCTS DIVISION

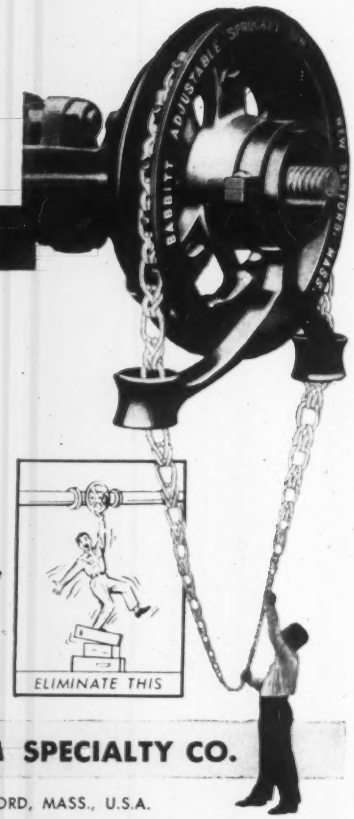
Engineered **Products Sold with** ***Service***

Safe Operation of Overhead Valves with a

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide

- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance; first cost *only* cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices



Babbitt STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

FREE – The Full Story Of Economical Infra-Red Comfort Heating

Industrial and commercial buildings of all kinds are now being heated by economical gas-fired overhead PANELBLOCS – the unit that "Heats Like the Sun." Panelbloc offers an entirely new heating concept. Unlike traditional heating equipment that heats the air, Panelbloc heats objects and people.

Panelbloc is low in first cost, installation is economical, since no electrical connections are needed. No fans or motors are needed for these unique heaters.

We have a complete literature file on this equipment, and you are welcome to any items you'd like to have.

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This pictures and describes the equipment, gives dimensions and technical data, operating principle.

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This lavishly illustrated brochure shows actual installations in a wide range of commercial and industrial plants.

PANELBLOC CASE HISTORIES
Tell us what your business is, and we'll send you a case history describing Panelbloc in a business similar to your own.

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Learn what the experts say about Panelbloc.

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The Bettcher Mfg. Corp.
3106 West 61 St., Cleveland, Ohio

OVERHEAD PANELBLOC

EQUIPMENT DEVELOPMENTS
Continued

Evaporator Blowers . . .

. . . available in 3, 5, $7\frac{1}{2}$, 10 ton capacities—*Mathes Co., Div. of Glen Alden Corp., Dept. HPAC, 1501 E. Broadway, Fort Worth 5.*

"Lo-Silhouette" evaporator blowers designed for free discharge application in installations with limited ceiling height, as low as 8 or 9 ft. Overall height of 3 ton unit is 17 in.; 10 ton unit is 22 in. overall.

Equipment Briefs . . .

PIPE NIPPLES designed for use as both inlet and outlet for water heater tanks—*Perfection Pipe Nipple Co., Dept. HPAC, Madison, Ohio.* Three new types include "Coppersert" nipple; "Dip Tube" nipple; gas valve nipple. "Coppertube" nipple made of steel with copper tube liner in $\frac{3}{4}$ in. size, $2\frac{1}{2}$ through 7 in. in length. Nipple combines inlet nipple, plastic dip tube in single unit.

RIVET DRAWING HAMMER for use with copper, aluminum, stainless steel, or galvanized steel—*Pattern Development Template Co., Dept. HPAC, 4007 Magnolia, St. Louis 10.* Choice of mallet ends offered: hard rubber or extra hard neoprene inserts.

ELECTRIC DRILLS available in $\frac{1}{4}$, 5 to, $\frac{3}{8}$ in. sizes—*Speedway Div., Thor Power Tool Co., Dept. HPAC, 1421 Barnsdale Rd., La Grange, Ill.* "No. 1200 Series Speed Drills" designed for heavy duty continuous operation. "No. 1300 Series" available for intermittent service applications. Drills weigh $4\frac{1}{2}$ lb. and vary in length from 9 to $9\frac{5}{8}$ in., depending on chuck capacity. Universal series wound motors provide power.

DRAFTING MACHINE in portable design—*David Miller & Associates, Dept. HPAC, Box 572, Beverly Hills, Calif.* "Draftette Senior No.

DeZURIK ..the BEST valve for air conditioning because.....

THEY'VE PROVED THEIR DEPENDABILITY!

On job after job — wherever they've been installed — DeZurik Valves have a record of dependable service, day after day, year after year.

This top record is a result of a number of advantages you get with DeZurik Valves — and ONLY DeZurik! First, you get easy operation, without jerking or sticking. Second, DeZurik Valves shut dead-tight every time, without lubrication! Even after long periods of inoperation. And they're perfect for balancing, with excellent throttling characteristics — and no stem leakage to fear!

These, and many other advantages, have contributed to DeZurik Valves' record of dependability. And this record is responsible for the increasing use of DeZurik Valves in air conditioning systems.

Available in sizes ½" thru 20", in 2-way, 3-way or 4-way models with manual, on-off or positioning actuators. For more details, see the DeZurik representative in your area, or write Dept. AC for a complete list of installations.

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SARTELL, MINNESOTA

Only DeZurik Valves give you all these advantages:

1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

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Super-Strength Adhesives

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
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TUFF-BOND 21-W
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. . . exceptionally high-strength chemical-set adhesive with wide thermal range −100° F. to 350° F.

TUFF-BOND #1000
. . . high heat resistance for bedding and installing high temperature insulation

TUFF-BOND #12
. . . high pressure duct sealer

TUFF-BOND QUIK-SET
. . . neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

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. . . all-around adhesive for installing insulation, insulation hangers, etc.

Ask for descriptive literature and prices.

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INCORPORATED
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EQUIPMENT DEVELOPMENTS

Continued

12" is constructed of aluminum, black anodized, and has 6 × 9 in. interchangeable scale with white numerals. It is divided into 16ths or 10/50ths, with a 360 deg protactor. Machine is completely assembled on lightweight 20 × 26 in. drawing board.

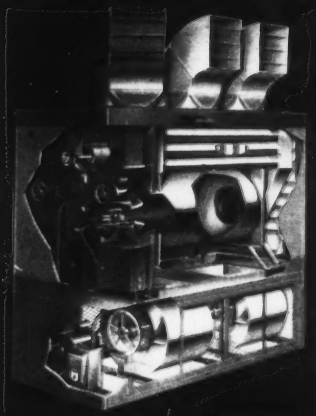
TEMPERATURE CONTROL designed to control, indicate temperature of gases, liquids over variety of ranges between −100 and 600 F—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.* "Type E36N" temperature control has aluminum, dial, nickel plated brass bellows housing with copper capillary, and stainless steel bulb. Switches available include normally open, normally closed, and double-throw. All switches are single-pole, suitable for up to 180 F ambient temperature. Ratings are 15 amp and 20 amp, 115/230 volts, a-c.

PIPE INSULATION developed to prevent condensation and "sweating" of cold water pipes, and for insulation on hot water pipes—*Rhopac, Inc., Dept. HPAC, 3425 Cleveland St., Skokie, Ill.* "Easy Wrap" consists of glass fiber insulating material and outer wrap of vapor sealing tape. Insulating material is fireproof, acid resistant with high thermal insulating efficiency.

FAN BLADES of interchangeable hub type—*Ventco, Inc., Dept. HPAC, 2000 Caroline St., Houston 4.* Adapter fan blades have uniform size openings. Hub can be quickly assembled to any blade with three screws. Adapter blades manufactured in six sizes from 10 to 24 in., in both 3 blade and 4 blade styles, clockwise and counter-clockwise and in various degrees of pitch. Interchangeable hubs come in six bore sizes ranging from $\frac{1}{4}$ to $\frac{3}{4}$ in. in bore. ≠

LENNOX

"OG" SERIES INDUSTRIAL HEATER



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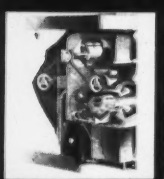
Efficient heat transfer design results in reduced physical size of this heater . . . allowing it to take up a minimum of space. If floor space is at a premium, the "OG" can be suspended horizontally or inverted. Removable nozzles permit free standing or ducted installations.



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Burner operates equally well with either gas or oil. Changeover is instant and automatic.

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Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters.

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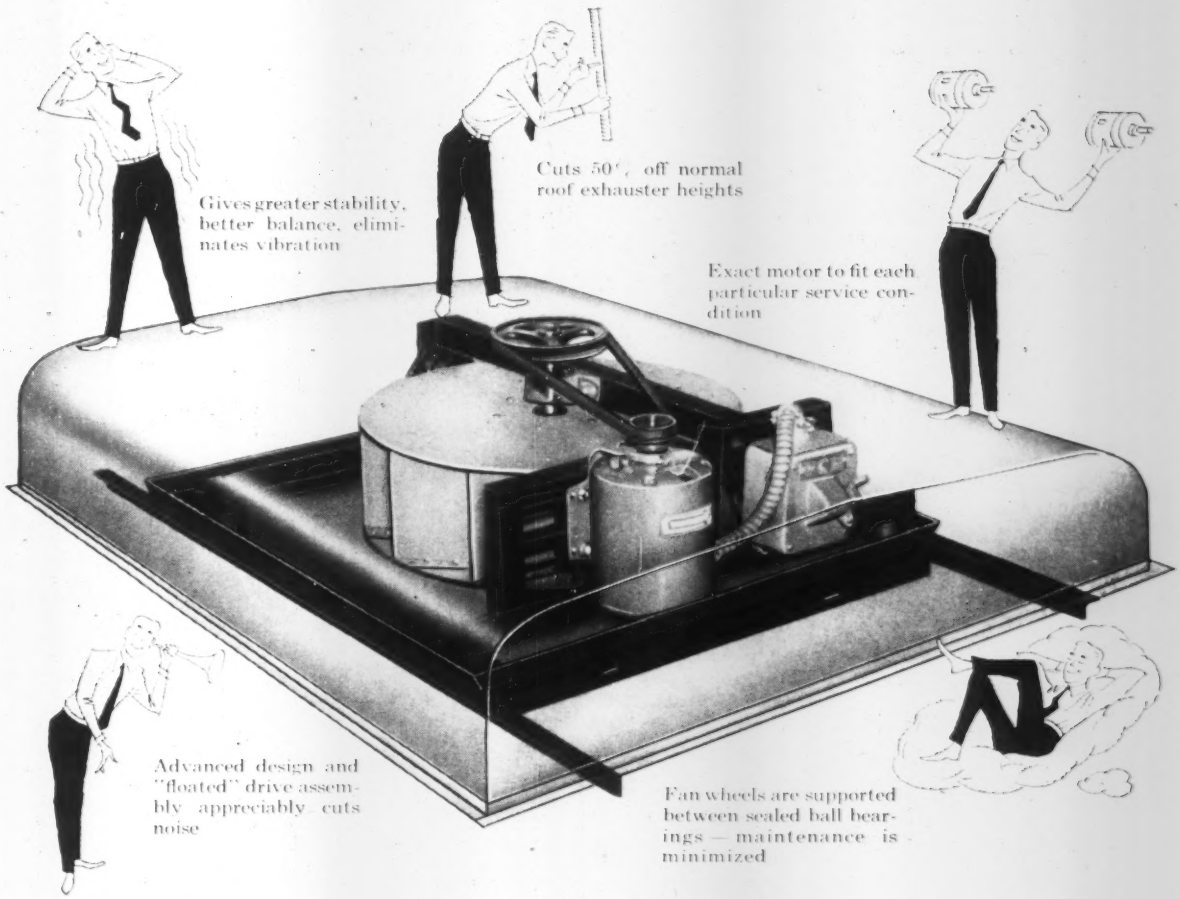
Company.....
Address.....City.....
Title.....

It's what you can't see that's important!

PENN VENTILATOR'S TRULY LOW-CONTOUR DYNAFAN


Gives greater stability, better balance, eliminates vibration
Cuts 50% off normal roof exhauster heights
Exact motor to fit each particular service condition
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Fan wheels are supported between sealed ball bearings — maintenance is minimized

The highest quality and unobtrusive appearance are yours when you use the Low-Contour Dynafan roof exhauster. Identical housing designs are available for both supply and relief units, also. The Penn Ventilator man in your area can give you complete details. Call him . . . today.

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Therm-O-Tile has been tested and proved to give high quality performance, with minimum heat loss.

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RECENT TRADE LITERATURE...

▶ *ADJUSTABLE SHEAVES*—New bulletin "20B9125" describes company's new "Adjustex" adjustable sheaves made in 2, 3, 4 grooves for use with A, B, C section belts. Brochure includes table of sheave dimensions. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee* 1.

▶ *ADJUSTABLE SPEED DRIVES*—Specification sheet on adjustable speed drives in three series outlines features of design, construction, gives ratings, specifications for each series. *Cleveland Machine Controls, Inc., Dept. HPAC, 1155 Brookpark Rd., Cleveland* 9.

▶ *BLOWER PERFORMANCE*—Two technical data sheets on performance, dimensions of company's line of "Radiax" blower units recently made available. Designated "RX1" and "RX2", bulletins describe materials, finishes, list important dimensions, give pressure, speed, power, current curves for each blower size. *Air Impeller Div., Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

▶ *BRAZING TORCHES*—Illustrated 4 page bulletin presents manufacturer's No. 81 hand torch for brazing applications. Performance of model, technique to be used with it are discussed in publication. *Handy & Harman, Dept. HPAC, 82 Fulton St., New York* 38.

▶ *COLORIMETRIC ANALYZERS*—"Bulletin 1156-1," entitled "Quantichem Automatic Colorimetric Analyzers" describes industrial instruments available for colorimetric determinations of trace quantities of substances dissolved in liquid process streams. Bulletin gives details on analyzers for dissolved silica, dissolved oxygen and total water hardness. Schematic diagrams included with descriptions of pneumatic programmer, unique sample cells, devices for measuring reagent. *Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia* 18.

▶ *COMBUSTION CONTROL*—Diagrammatics of typical combustion control systems as applied to stoker-fired boilers given in new, 4 page "Bulletin 515." Chain-grate and spreader type stokers are covered, with discussion of steam pressure and steam flow-air flow measurement. *Bailey Meter Co., Dept. HPAC, 1050 Ivanhoe Rd., Cleveland* 10.

▶ *COMPRESSED AIR DRYER*—"Bulletin R-54" presents description of operation, features of manufacturer's line of compressed air and gas dryers. Com-

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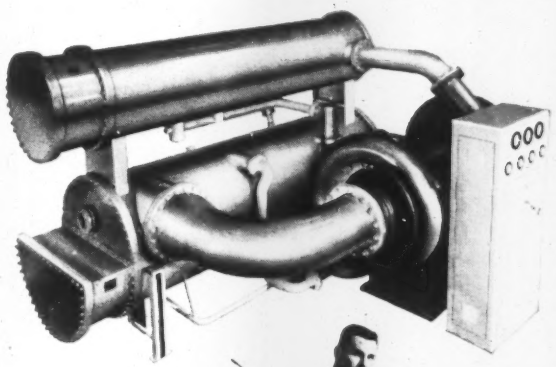
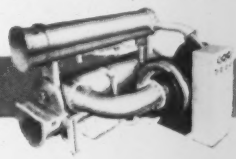
...most versanomical way to air condition anything!

Versanomical—that's the word for Chrysler's Centrifugal Water Chiller. It's versatile: engineered for any air conditioning project from 125 hp to the largest. And economical: packed with special engineering features that cut operating and service costs. For example:



1. **True volute casing.** A Chrysler design exclusive that minimizes refrigerant turbulence . . . reducing horsepower load on the motor.
2. **Adjustable guide vanes.** Unique airfoil design employs new principles to increase compressor efficiency to the maximum while maintaining operating stability.
3. **Automatic operation.** Factory-assembled control console including all required safety controls, indicator lights and gauges.
4. **Automatic purger.** Removes non-condensable gases and water vapor. Prevents contamination of refrigerant system, cuts service costs.
5. **Interlocked lubrication.** System protects motor bearings with a constant flow of oil. Compressor can't run unless oil pump operates.

Chrysler Centrifugal Water Chillers are factory pre-tested under simulated operating conditions to assure peak performance. Get complete engineering data and technical assistance from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. Y-89, Dayton 1, Ohio.



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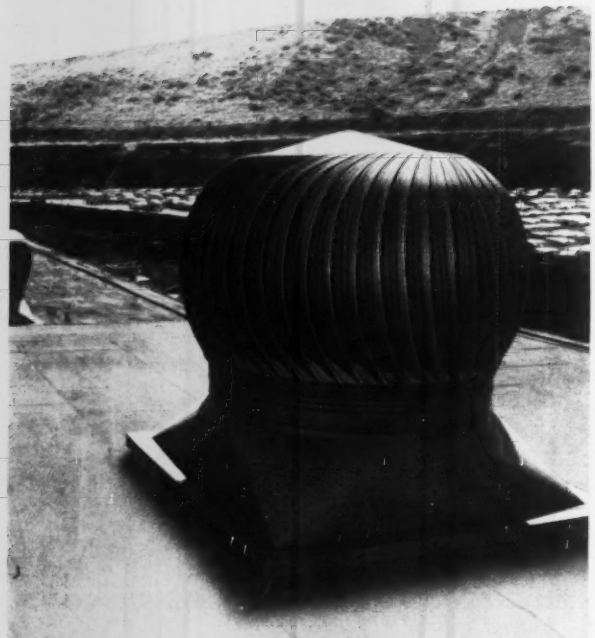
FIRST WITH THE FINEST IN AIR CONDITIONING



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Western Rotary® Roof Ventilators

with Lifetime Guaranteed Bearings

- "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity, no backdraft ever.
- Certified wind tunnel tests by non-commercial national institute.
- Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
- Lock-on rotor, yet removable without special tools.
- Exclusive Western corrugated vane increases rigidity.
- Low, functional type adds beauty.
- Baked enamel paint coating for beauty and long life.
- Aluminum, copper, or stainless steel construction available.

Other type ventilators include:

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- Continuous ridge
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RECENT TRADE LITERATURE

Continued

plete unit specifications, capacities presented in tables, graphs. Publication illustrated with photos, diagrams. *Desomatic Products, Inc., Dept. HPAC, 1109 W. Broad St., Falls Church, Va.*

▶ *CONDENSATION PUMPS*—Design features of condensation pumps for steam heating systems described in new catalog "K-200." Ratings, capacities, pressure, speeds given for six different types of pumps. Installation diagrams, detail drawings, photos also included. *C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh Ave., Philadelphia 32.*

▶ *COOLING TOWERS*—"Bulletin 53-902" presents information on line of horizontal induced draft steel cooling towers with capacities from 2 to 120 tons. Diagrams show operation, photos illustrate construction of towers. Specifications, capacities, engineering data for all models included in bulletin. *J. F. Pritchard & Co. of California, Dept. HPAC, 4625 Roanoke Pkwy., Kansas City 12, Mo.*

▶ *DIFFERENTIAL PRESSURE REGULATORS*—Illustrated catalog sheet describes company's two new differential pressure regulators for steam service, "Fig. 1200, Type C," and "Fig. 1210, Type C." Catalog sheet has photos, lists of materials, ordering information, information on installation, method of operation of both valves. *Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5, N. J.*

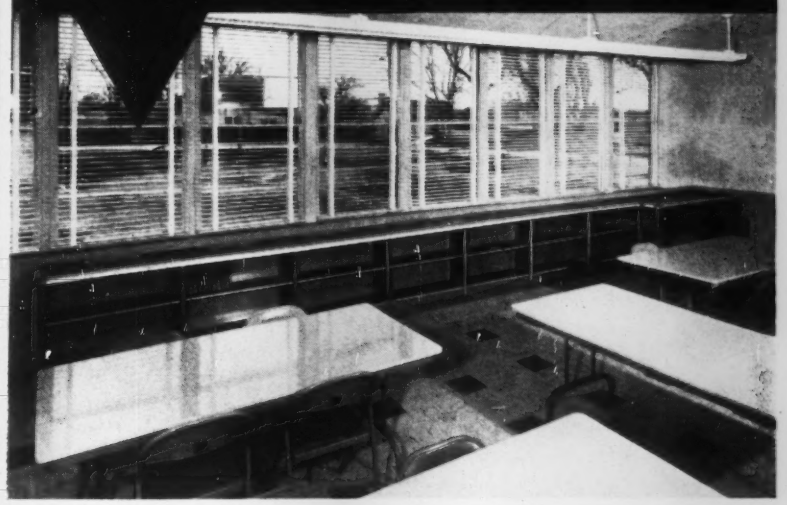
▶ *DISSOLVED OXYGEN METER*—Description, details of three basic unit which compose company's dissolved oxygen meter given in three separate bulletins, "58-B627," "58-B631," and "58-B771." Units are: "Model 627 Contact Sampler," "Model 631 Magno-Therm Analyzer," and "Model 771 Universal Recorder." Illustrations in publications include schematic diagram of operation. Specifications on all components also included. *Hays Corp., Dept. HPAC, 800 E. Eighth St., Michigan City, Ind.*

▶ *ELECTRONIC AIR CLEANER*—New 16 page product bulletin describes "Model B Rollotron" electronic air cleaner. Details of operation, electronic principle, explanation of agglomerator and storage sections are included in publication. Also given are equipment drawings, capacity, dimension tables, specifications, list of typical installations. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

Complete heating and ventilating

Classroom Comfort

PLUS TRIPLE ECONOMY



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ECONOMY OF MAINTENANCE . . . Sturdy construction, finest materials and latest A.G.A. approved controls — standard to industry — assures long, trouble-free performance.

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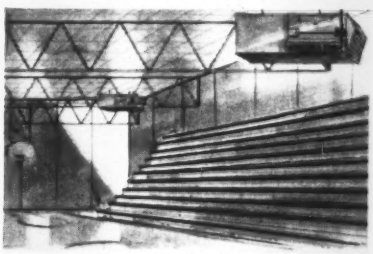
Compact!

Unit Heater or Central System

Norman® Southerner®

HORIZONTAL GAS FURNACES



- Saves floor space . . . can be located high out of the way.
- Saves installation time and costs . . . can be installed as a duct system.
- Versatile . . . outstanding performance when used as **unit heater** in commercial installations where extra velocity and quietness are required.
- A.G.A. approved for use as **either** central heating system or as a **blower-type unit heater** with any type of gas. Also approved for attic installations.

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RECENT TRADE LITERATURE

Continued

▶ *ELECTRIC CABINET HEATERS*—New bulletin "No. 1301" gives details of three new electric cabinet heaters. Two blow-through units and one draw-through unit are covered. Units designed for flexibility of arrangement and operation. *Hg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

▶ *ELECTRIC UNIT HEATER*—Complete specifications, construction information on manufacturer's line of electric unit heaters given in new 4 page bulletin, "No. 808." Data given on 14 models. *Hg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

▶ *EXPANSION JOINTS*—New 72 page bulletin "No. 59-50" gives detailed information on company's line of "Corruflex" packless expansion joints. Information on details of engineering and construction, installation data, applications included in publication together with dimensions, specifications, other engineering data. Completely illustrated with photos, drawings. Requests should be on company letterhead. *Adsco Div., Yuba Consolidated Industries, Inc., Dept. HPAC, 20 Milburn St., Buffalo 12, N. Y.*

▶ *FLOW CONTROL VALVE*—New catalog presents company's new "iris-type" flow control valves designed to provide accurate flow control and positive shutoff of bulk materials from bins and chutes, and for regulating air in heating and ventilating. Valve has flexible diaphragm which opens, closes through continuously variable concentric apertures. Illustrated sheet gives descriptions, data and specifications for five sizes with from 4 to 12 in. maximum openings. *Syntron Co., Dept. HPAC, 161 Lexington Ave., Homer City, Pa.*

▶ *HEATING CONTROLS*—New catalog of heating controls available from manufacturer. Publication contains many new listings of steam pressure and gas controls, valves, other items. *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

▶ *INSTRUMENT PANELS*—Details of construction, dimensions, weights, instrument mounting, accessories for six standard styles of instrument and control panels given in new, 16 page "Product Specification G71-7." Standard procedures for tubing, wiring presented. *Bailey Meter Co., Dept. HPAC, 1050 Ivanhoe Rd., Cleveland 10.*

▶ *INSULATING CEMENT*—"507 Quik-Kote" one-coat asbestos insulating cement described, illustrated in catalog page. Developed for insulating applications including fittings, boilers, vessels, tanks, breechings on smooth or irregular surfaces to prevent heat loss and fuel waste. Mixes with water, can be applied with trowel or by hand. *Grant Wilson, Inc., Dept. HPAC, 111 W. Jackson Blvd., Chicago 4.*

Hottest "Spot" in the Shop

the NEW miller LECTRO SPOT

Simply depress lever and tongs grip metal at pre-determined pressure, switch is turned on and weld sequence timer is actuated for precise period set on control dial. Thus, every weld is identical until timer adjustment is changed. Pilot light indicates when welder is connected.

This advanced design plus light weight and wide selection of tongs make the new Miller Lectro Spot the finest welder of its type.

Available in three styles: 115v or 230v, 1.5 KVA models for work to 1/8" thickness, both weigh 29 lbs.; 230v, 2.5 KVA model for mild steel to 5/32", weighs 37 lbs.

Complete specifications with tong and tip availabilities will be sent promptly upon request.

miller ELECTRIC MANUFACTURING COMPANY, INC. • Appleton, Wisconsin

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

steel pipe snow melting systems pull customers in, provide walking safety, eliminate sidewalk maintenance

Today's store traffic competition is keen. That's why modern retailers are so aware of their "exterior image." The sales impressions their fronts and window displays create often mean the difference between profit and loss.

One of the most dramatic, effective and low-cost ways that you can provide the organizations you serve with "added sales extra" is to recommend *steel pipe* snow melting systems. Thousands of business places have tested and proved the magnetic attraction that automatic snow melting gives. Pavements clear of snow and ice draw customers in . . . and it's the kind of service that creates the very best image to customers, prospects and the community alike.

Sturdy, durable *steel pipe is first choice* for automatic snow melting, with reason. It is economical, easy to work, simple to install. The same advantages make *steel pipe first choice* for fire sprinkler systems, conduit, vent and drainage lines, structural uses, radiant heating, refrigeration and gas, air and water transmission. Next time, make it *steel pipe*.

Illustration from booklet "Snow Melting and Ice Removal" shows steps in a sidewalk installation. For details on snow melting systems, write for this 32-page booklet.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

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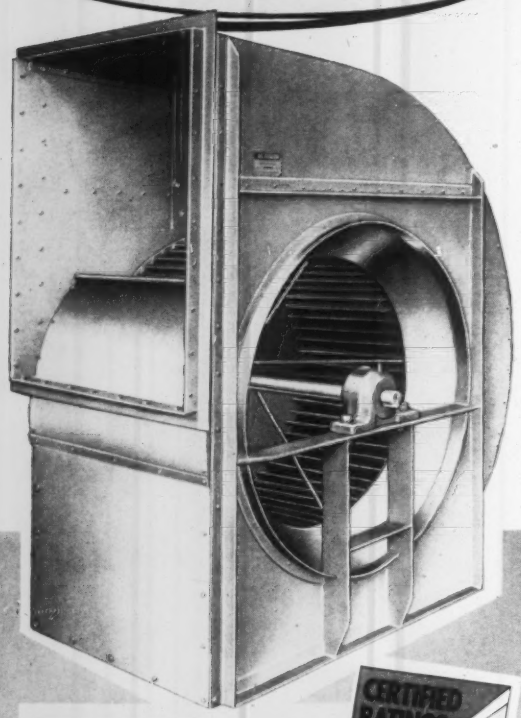
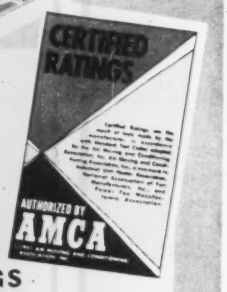


FANS *with built-in quality*

- EFFICIENT
- QUIET OPERATING
- CERTIFIED RATINGS



ALADDIN Series 94 Type FC Fans are available in 22 sizes both single and double width. These fans have been designed for the lowest rotational speeds consistant with high efficiency over the widest possible range of operating conditions.

Each fan is ruggedly built . . . fully equal to the job for which it is designed, and is backed by thirty-five years of know-how in manufacturing all types of air handling equipment.

Write for complete data

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1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

A3

RECENT TRADE LITERATURE

Continued

▸ *LEVEL INDICATORS*—"A Guide to Petrometer Products" is title of new 4 page "Bulletin A." In publication company's complete line of liquid level indicators and controls are described, including information on "Series 1400" industrial liquid level indicators, "Series 1329" fuel oil indicators, dial indicators, truck tank indicators, "No. 1561" specific gravity indicator, manifold valves, and other equipment. *Petrometer Corp., Dept. HPAC, 43-22 Tenth St., Long Island City 1, N. Y.*

▸ *LIGHT WALL FITTINGS*—"Pipe-Mate" light wall, stainless steel fittings and flanges for non-critical process piping described in 6 page bulletin. Charts give dimensions, design properties and dimensional tolerances. Bulletin "TT942" also available describing line of fittings. *Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville 1, Ky.*

▸ *METAL-FILLED CEMENT*—Information on composition and application of company's "Metalset A-1" epoxy resin aluminum cement presented in new 4 page bulletin. Material is available in tubes identified by weight and volume. Bulletin is illustrated with photos. *Smooth-On Mfg. Co., Dept. HPAC, 572 Communipaw Ave., Jersey City, N. J.*

▸ *MULTI-CONDUCTOR CABLE*—Illustrated catalog "No. 33" describes new type of polyvinyl insulated, multi-conductor cable for installing 6 to 56 pairs of thermocouple loads at one time. Publication contains information on construction, ISA color coding and calibration symbols, applications, features. Also includes resistance tables for pyrometer wires and electrical properties chart of thermocouple conductor materials. *Thermo-Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

▸ *NOISE CONTROL*—"Uni-Silencer" selection chart illustrated with three data charts covering high pressure systems, centrifugal fan pressures, pressure drop and airflow, different types of "Uni-Silencer" models available. Units designed for control of air conditioning and ventilating system noise. *Elof Hansson, Inc., Dept. HPAC, 711 Third Ave., New York 17.*

▸ *PANEL-COIL*—New "Price Data Bulletin No. 259" describes company's line of "Thermo-Panel" coil. Product is made of wide variety of metals in designs which make possible increase in capacity. Included in bulletin are illustrations, data tables. *Dean Products, Inc., Dean Thermo-Panel Coil Div., Dept. HPAC, 616 Franklin Ave., Brooklyn 38.*

MSA reports on:

How Air Filter Efficiency Is Tested

MSA presents the following information in a spirit of helpful enlightenment. It's directed to those of you in industry who want to know more about air filter efficiency and how it's determined. A review of this report may pose a question or two in your mind. We hope you will write us for answers to your specific air cleaning problems.

TESTS BASED ON WEIGHT—Efficiency equals total weight of dust in unfiltered air stream divided into total weight of dust stopped by filter, times 100.

The best known weight tests used today are the ASHVE and Bureau of Mines procedures. Both use prepared "standard" dusts of relatively large particle diameter. Most sources agree that "atmospheric dust" would be the most representative material to use on a weight test for space filters. But so far, the average atmospheric dust condition has not been selected. Type of material, concentration, particle size, etc., varies widely from one location to another. And even within the same location from time to time.

TESTS BASED ON DISCOLORING—Efficiency is found by comparing previously rated standard stains.

These tests follow the practice of comparing stains produced on white filter paper by the exit of air from the filter being tested with a series of known standards made by staining papers with different volumes of untreated aerosols.

Comparisons are made visually or by a densitometer (degree of light penetration). NBS or ASHVE dusts are most frequently used on these tests although some reports are based on use of atmospheric dusts.

Efficiencies reported by discoloration are usually lower than those reported by weight; but considerably higher than those obtained by count.

TESTS BASED ON COUNT—Efficiency equals total number of particles in unfiltered air stream divided into total number of particles stopped by filter, times 100.

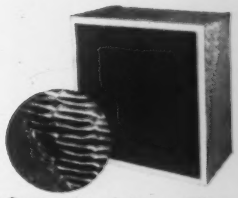
Efficiencies obtained by count are the most exacting measure of a filter performance since large and small particles are rated equally. They can be counted by means of a microscope or by light scattering techniques.

The most critical standard test and the most difficult for any particulate filter is the Chemical Corps DOP test on which penetration of the 0.3 micron diameter smoke particles is evaluated by particle count.

The DOP Penetrometer, used on the M-S-A UltraAire Space Filter, is now considered the most convenient tester available. It is sensitive to penetrations as low as 0.001% by count. It's sometimes difficult to appreciate the difference between 99.95% efficiency and 99.90% efficiency.

TESTS BASED ON RADIOACTIVITY—Efficiency equals radioactivity of unfiltered air stream divided into radioactivity of particles stopped by filter, times 100.

One of the earlier tests on this basis involved the use of triphenyl phosphate containing radioactive sulphur. This or like materials in a uniform aerosol are passed through filter paper or pads, and segments of these are analyzed with a Geiger Counter or some other similar instrument. Such test procedures are still confined primarily to AEC activities.

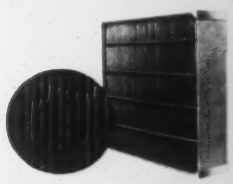


M-S-A® UltraAire* Space Filter

Light weight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pre-tested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

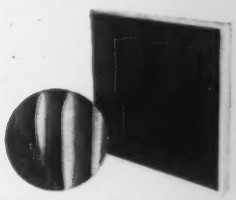
M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems. Weighs only one pound. Easy to handle. Inexpensive to ship.



M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Atmospheric Air Dust Stain Rating.



M-S-A® Air-O-Kay* PreFilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large air-borne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

*Trademark

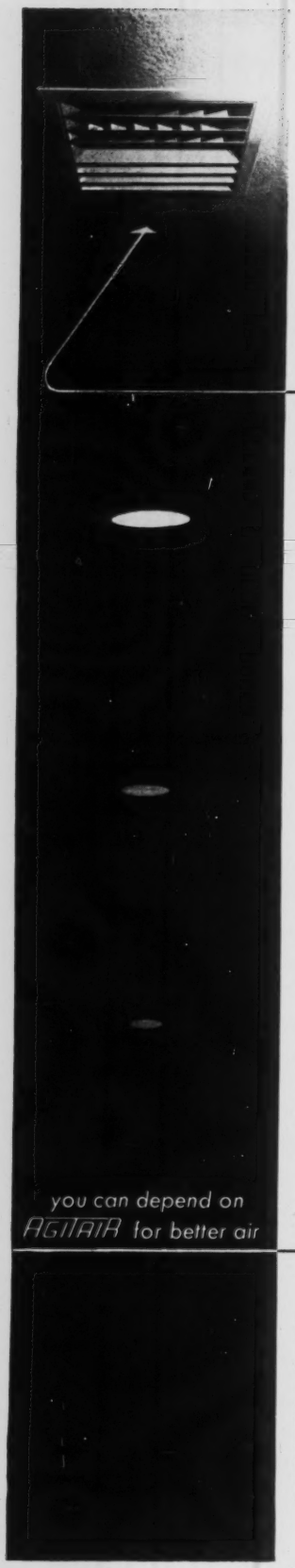
Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations.

Fluid Purification Specialists For 45 Years

MINE SAFETY APPLIANCES COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.

Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators, space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.


Custom Made
AIR DIFFUSERS
with
DIFFUSING VANES
Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.
These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.
AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.
Write for your copy today.
you can depend on AGITAIR for better air
AIR DEVICES INC.
185 MADISON AVE., N. Y. 16, N. Y.
air diffusers • filters • exhausters

RECENT TRADE LITERATURE

Continued

▸ *PIPE CLAMPS*—New 94 page engineering design manual "TA210G" describes manufacturer's complete line of standard clamps, line supports, brackets, shims in variety of shapes, sizes. Over 100 illustrations included with complete dimensions, specifications in chart form. *TA Mfg. Corp., Dept. HPAC, 4607 Alger St., Los Angeles 39.*

▸ *PIPE FITTINGS*—New hydraulic, pneumatic and vacuum contains flow charts, information for engineering and maintenance departments. Contains complete data on company's O-ring seal tube fittings, flare fittings, pipe fittings, tube benders, other hydraulic components. *Lenz Co., Dept. HPAC, Box 1044, Dayton 1, Ohio.*

▸ *PIPE MARKERS*—New bulletin "No. 803" presents line of pipe markers for identification on pipes, cables, conductors, conduit, panel boards, etc. Markers manufactured of permanent vinyl plastic with pressure sensitive backing. Complete line of ready-marked plastic markers listed in bulletin. *Seton Name Plate Co., Dept. HPAC, 131 W. Rock Ave., New Haven 15, Conn.*

▸ *PIPE WELDING*—Two technical articles—"Fabrication of Small Piping by Welding and Brazing" and "Designing for Welded Systems of Small Size Pipe"—available for the information of all engaged in installation of small size non-critical piping. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 150 E. 42nd St., New York 17.*

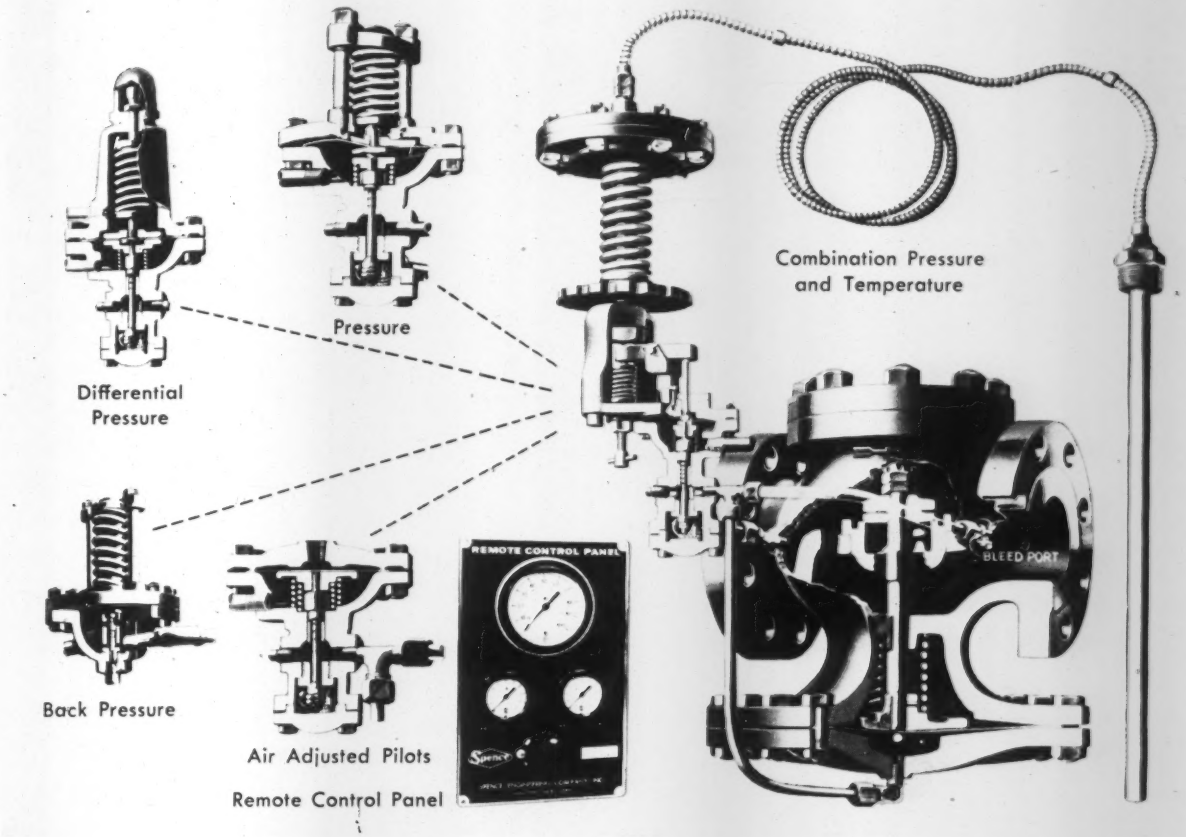
▸ *PLASTIC FITTINGS*—UPVC drainage fittings recommended for industrial piping applications described in new brochure. Assembly of cemented UPVC joints illustrated; specifications for drainage fittings included. *Tube Turns Plastics, Inc., Dept. HPAC, 2929 Magazine St., Louisville 11, Ky.*

▸ *PLASTIC PIPE*—New 15 page brochure discusses semi-rigid plastic pipe for radiant heating applications. Reasons for using plastic pipe in such applications discussed, together with system design, insulation, installation. Publication is fully illustrated with photos, diagrams. *Triangle Conduit & Cable Co., Inc., Plastic Pipe Div., Dept. HPAC, Triangle and Jersey Aves., New Brunswick, N. J.*

▸ *PLASTIC PIPE FITTINGS*—New catalog sheets for 1959 list full line of plastic fittings, giving general information, sizes and prices on socket and combination type tees, bushings, threaded nipples and saddles. Catalog "No. IF4" pertains to plastic insert fittings

VALVE TIPS:

All Pilots Fit All Main Valve Sizes Downtime, Maintenance, Inventory Reduced



Let's start off by admitting there's no such thing as a "maintenance-free" regulating valve. Any valve that automatically controls temperatures or pressures within close limits can be affected by dirt in steam lines.

If trouble does develop, engineers want a regulator they can get back on the line — fast. That's one reason why more engineers are standardizing on Spence Regulating Valves with externally mounted pilots. The simple test of disconnecting the external bends establishes whether the trouble is in the main valve or the pilot.

If the main valve is the trouble spot, it can be maintained without removing the valve body from the line. If the pilot is the trouble spot, it is easily removed for cleaning. However, if production downtime is a strong factor, the fastest method is to install a spare pilot and it is inexpensive.

All Spence pilots fit all sizes of Spence main valves. If you have twenty pressure regulators, for instance, all you need is *one spare pilot*. It will fit all main valve sizes from ¼" to 12".

Another advantage of the Spence design is the external pilot is interchangeable. You can change the function of a regulator by merely changing the pilot. In many plants this can represent an important factor in reduced inventory costs because you only carry a few inexpensive extra pilots instead of complete regulators. Obviously, there is also a considerable savings in labor costs when a valve can be converted, in the line, from a temperature regulator to any one of various pressure regulators.

The pictures above show a few of Spence's wide line of automatic regulators. For more information write for Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York 8E-145

PROBLEM:

Cooling towers—find a nozzle that delivers large droplets at low pressure

SOLUTION:

Delavan Types WR or WC nozzles

Both these Delavan nozzles operate effectively at pressures as low as 2 psi. Produce large droplets with minimum drift-age. Clogging is held to a minimum. There are no vanes, cores or other obstruction to promote corrosion build-up. WR and WC deliver uniformly distributed, hollow cone patterns for maximum heat transfer. They're accurately calibrated to the capacity and spray angle you request. A wide range of capacities, pipe sizes and materials is available.

If the right nozzle will improve your air conditioning equipment, there's a Delavan nozzle that will do it better. Write for Catalog 33A today.

DELAVAN
Manufacturing Company
WEST DES MOINES, IOWA
WORLD'S LARGEST NOZZLE SPECIALIST

RECENT TRADE LITERATURE

Continued

for polyethylene pipe (in nylon or styrene copolymers). Sections of catalog cover adapters, couplings, ells, tees, insert crosses, threaded reducer bushings, etc. *R & K Plastic Industries Co., Industrial Plastic Fittings Div., Dept. HPAC, 11 W. Pennsylvania Ave., Towson 4, Md.*

▶ *POLYESTER RESINS*—New 4 page pamphlet introduces "Uraloy 7116" chemical and corrosion resistant polyester resin. Composition, applications, capacities of resin discussed in new publication. *Inter-Chemical Corp., Finishes Div., Dept. HPAC, P. O. Box 659, Newark 1, N. J.*

▶ *POWER TRANSMISSION*—New 8 page bulletin "A-706" presents manufacturer's line of power transmission machinery including steel conveyor pulleys, roller chain drives, various types of shaft couplings, and "Dyna-V" and "V-belt" drives. *Dodge Mfg. Corp., Dept. HPAC, 500 S. Union St., Mishawaka, Ind.*

▶ *PRECISION SWITCHES*—"Catalog No. 359" gives detailed information on expanded line of snap-acting precision switches. Dimension drawings, descriptions, force and movement specification tables, electrical ratings for each switch included. *Unimax Switch Div., W. L. Maxson Corp., Dept. HPAC, Ives Rd., Wallingford, Conn.*

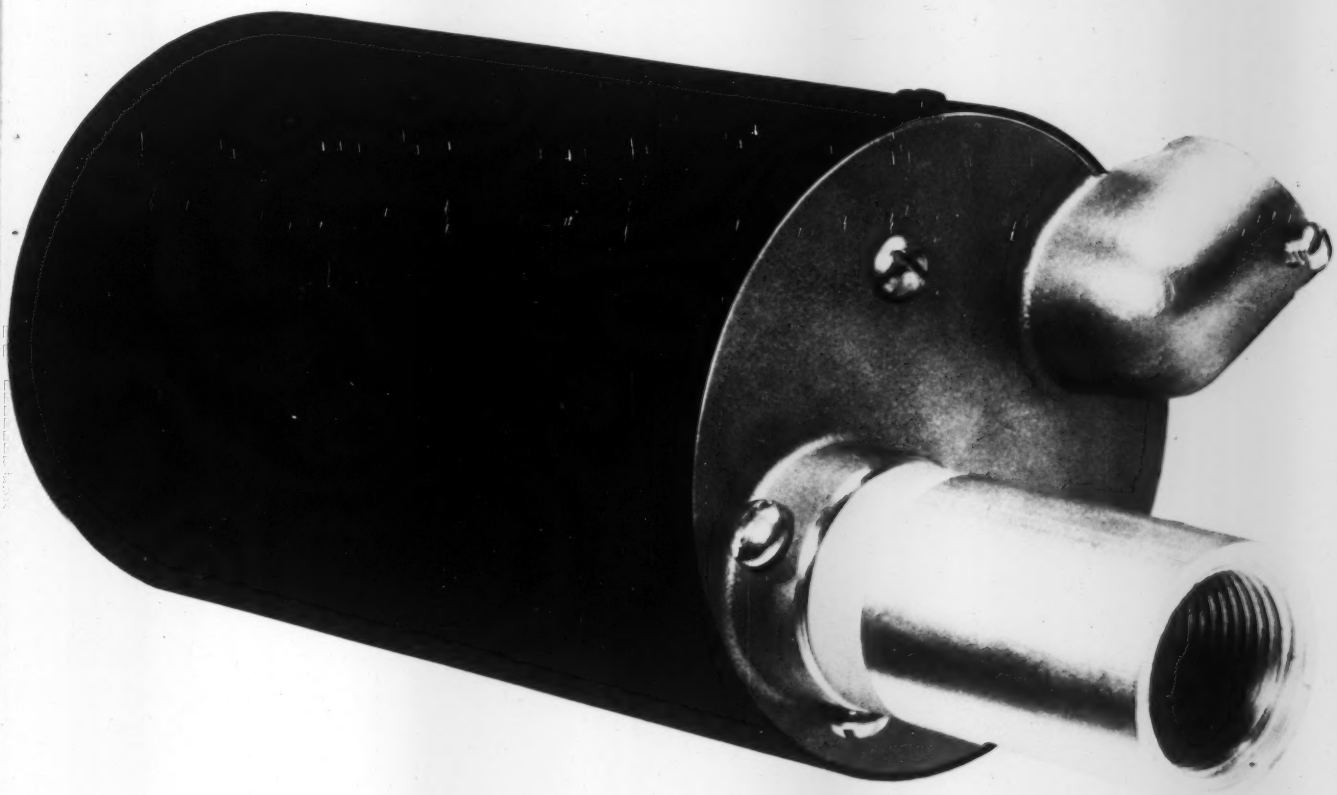
▶ *SEAMLESS WELDING FITTINGS*—New 12 page booklet "FB-78" provides guide to material selection of carbon, alloy and stainless steel welding fittings and flanges. Publication covers specifications, analyses, effects of alloying elements, mechanical properties and arc welding procedures. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▶ *SHEETS AND PLATES*—Over 100 different parts and assemblies included in company's new 40 page "Sheet & Plate Fabrication Catalog." Manufacturer's products described, illustrated; facilities, equipment involved in manufacture also shown. *Kirk & Blum Mfg. Co., Dept. HPAC, 3130 Forrer St., Cincinnati 9.*

▶ *SHEET METAL PRODUCTS*—Pocket-size, 64 page catalog includes product data, installation information on "Milcor" building specialties, ventilators, heating and air conditioning products, masonry building products, other sheet metal lines. *Inland Steel Products Co., Advertising Div., Dept. HPAC, P. O. Box 393, Milwaukee 1.*

HONEYWELL'S NEW C7012A

Ultra-Vision* Flame Detector



senses only the flame!

no more hot refractory hold-ins

USE OF ULTRAVIOLET RAYS REVOLUTIONIZES SAFETY STANDARDS IN FLAME DETECTION DEVICES FOR GAS, OIL AND COMBINATION GAS-OIL INSTALLATIONS

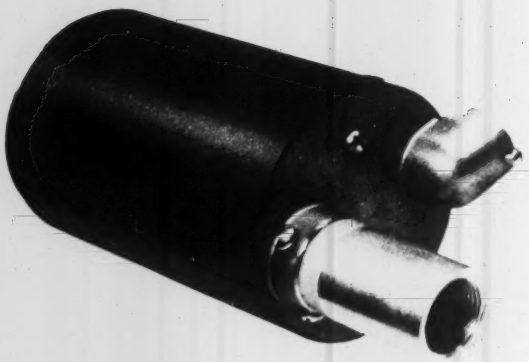
Honeywell's new ultraviolet sensor represents a major breakthrough in scientific flame detection. This revolutionary device employs an amplified ultraviolet signal to positively distinguish between an actual flame (ultraviolet rays) and a hot refractory (infrared rays). For the first time, you can be *absolutely sure* that fuel delivery will be stopped in the absence of flame.

This new control device is compact. It simplifies flame supervision of both single and multiple burners since the Ultra-Vision Detector, not being sensitive to a hot refractory, can be aimed at each individual flame in the most convenient way. This is the only device on the market that offers you this advantage.

Is it economical? Consider this: The amazing new Ultra-Vision Flame Detector will actually pay for itself in simplified installation and maintenance because—

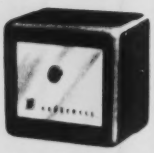
• wiring is less expensive in this system than in a lead sulphide cell • it can be installed easier because in flame sighting hot refractory can be ignored • there is no further need for flame rod replacement.

*Trademark



HONEYWELL'S NEW C7012 IS "SYSTEM ENGINEERED" FOR USE WITH ANY 2- TO 4-SECOND FLAME RECTIFICATION RELAY!

The Honeywell Ultra-Vision Flame Detector is designed for safe, foolproof flame detection when used with any of the following flame safeguard relays:

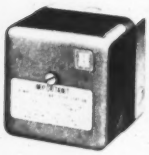


FOR MEDIUM BURNERS—
RA890E PROTECTORELAY

The RA890E is a basic rectification relay ideally suited for use with the new C7012A Ultra-Vision Sensor. It's designed especially for pressure-gun oil burners, small combination gas-oil burners and gas-power burners.

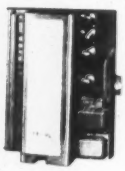
FOR INDUSTRIAL
PROCESSING BURNERS
AND OVENS—
W124 PROTECTOGLO

Provides extended purge timings and cutoff of the main flame. Pushbutton and signal lights are a built-in feature of this system. The Ultra-Vision Flame Detector provides safe, dependable flame detection when used with the W124 Protectoglo.



FOR INDUSTRIAL PROCESSING AND COMMERCIAL BURNERS (requiring manual start and complete cutoff on flame failure)—R485 PROTECTORELAY

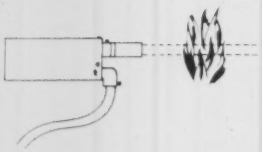
Used with the new C7012, the R485 Protectorelay insures trouble-free operation and no "down time"—this system senses only the flame, never a hot refractory. The safety features of the R485 include a warm-up timer, a self-start check and a safe-operation check for immediate shut-down in event of abnormal conditions.



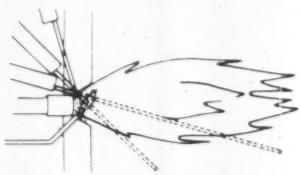
FOR LARGE CONVERSION BURNERS
—R478 PROTECTORELAY

Here's an electronic programming relay for large horizontal rotaries, combination gas-oil burners, steam-atomizing burners and large power gas burners. The R478A may be used with the C7012A Ultra-Vision Sensor when burner sequencing is needed.

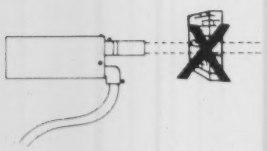
HERE'S WHY HONEYWELL'S NEW C7012 IS SO VERSATILE!



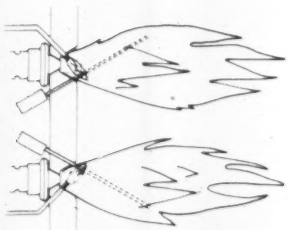
New Ultra-Vision Flame Detector sights flame of all fuels.



New Detector does an effective job on single burner pilot and main flame installations.



C7012 is not affected in any way by a hot refractory.



With Honeywell's new C7012, multiple burner installations can be monitored safely for the first time.

FOR MORE DETAILS, CALL YOUR LOCAL HONEYWELL OFFICE, OR WRITE TO HONEYWELL, MINNEAPOLIS 8, MINNESOTA; PHILADELPHIA 44, PENNSYLVANIA; OR TORONTO 17, ONTARIO

Honeywell

First in Control

76-4988 Printed in U.S.A.

RECENT TRADE LITERATURE

Continued

▸ *STEAM SPECIALTIES*—New product bulletin describes manufacturer's line of valves, thermostatic traps, float and thermostatic traps, steam traps (250 psig maximum pressure as well as blast and high pressure) and pipe line strainers. Operation, dimensions, capacities, patterns, weights, accessories all covered. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8, Ky.*

▸ *TEMPERATURE CONTROLS*—New 8 page condensed catalog describes company's temperature controls, allied equipment for industrial heating, refrigeration. Booklet contains charts, specifications, photos. *Partlow Corp., Dept. HPAC, 520 Campion Rd., New Hartford, N. Y.*

▸ *TWO-PASS BOILERS*—New 4 page bulletin presents advantages, features of two-pass boilers. Bulletin "BE-100" compares designs, illustrates "spinning gas technique" for heat transfer. Text illustrated with cross-sectional drawings, photographs. *Boiler Engineering & Supply Co., Inc., Dept. HPAC, Phoenixville, Pa.*

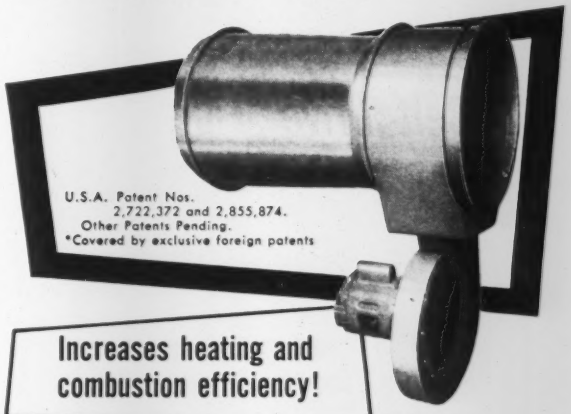
▸ *UNIT HEATERS*—"Bulletin GU-100" describes firm's line of gas-fired unit heaters. Construction features, physical data, dimensions and rating given in bulletin. *L. J. Wing Mfg. Co., Dept. HPAC, 140 Vreeland Mills Rd., Linden, N. J.*

▸ *VIBRATION INDICATOR*—New bulletin "K14A" describes company's "Reed Vibrometer" designed to measure and indicate frequency, amplitude of vibrations. *Korfund Co., Inc., Dept. HPAC, 48-01 F 32nd Pl., Long Island City 1, N. Y.*

▸ *WELDING FITTINGS*—"Catalog H-1" presents company's line of "Husky" fittings, designed for noncritical heating and cooling systems. Catalog lists sizes and styles from 45 and 90 deg elbows, through straight and reducing tees, and concentric reducers. *Nibco, Inc., Dept. HPAC, Elkhart, Ind.*

▸ *WELDING FITTINGS AND FLANGES*—Technical bulletin "FDC-262" and "FDC-269" give dimensions, diagrams of company's welding fittings, forged steel flanges in 5 and 18 in. sizes, respectively. Specifications for both sizes are given. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Milwaukee 46.*

Quickdraft... THE WORLD'S SAFEST POWER DRAFT UNIT FOR INDUSTRIAL, RESIDENTIAL AND INSTITUTIONAL EXHAUSTING



Increases heating and combustion efficiency!

Provides air power for bulk materials handling!

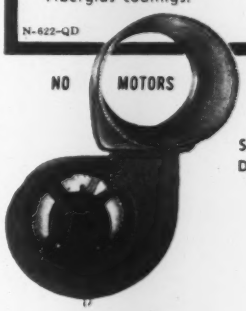
Exhausts corrosive gases and abrasives!

Quickdraft provides industry, commerce, institutions and homebuilders *power draft* engineered for economical and efficient combustion regardless of building or atmospheric conditions. Models suitable for every heating or incinerator application . . . eliminate pulsating or chattering, puffing, smoking and sooting. Reduce building costs, no tall, unsightly stacks required. Quickdraft also provides industry with ¼ inch to 60 inches W.G. static pressure for exhausting corrosive gases, abrasives and paint spray. Heavy-duty, high-pressure models, 6 inches to 30 inches diameter, are available for moving bulk materials or anything that can be moved by air. Because there are no motors, fans or bearings in exhaust line, only Quickdraft avoids costly clogging, corrosion of moving parts or fan failure.

IMPORTANT NOTICE

For withstanding corrosive gases, all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P.V.C.) and with plastic and Fiberglas coatings.

N-622-QD



NO MOTORS FANS OR BEARINGS IN EXHAUST LINE

Send for QUICKDRAFT ENGINEERING DATA on your application . . . now.

Quickdraft CORPORATION

P.O. Box 17-K, Canton 1, Ohio

INCREASED AIR FLOW..... SUPER-QUIET OPERATION!

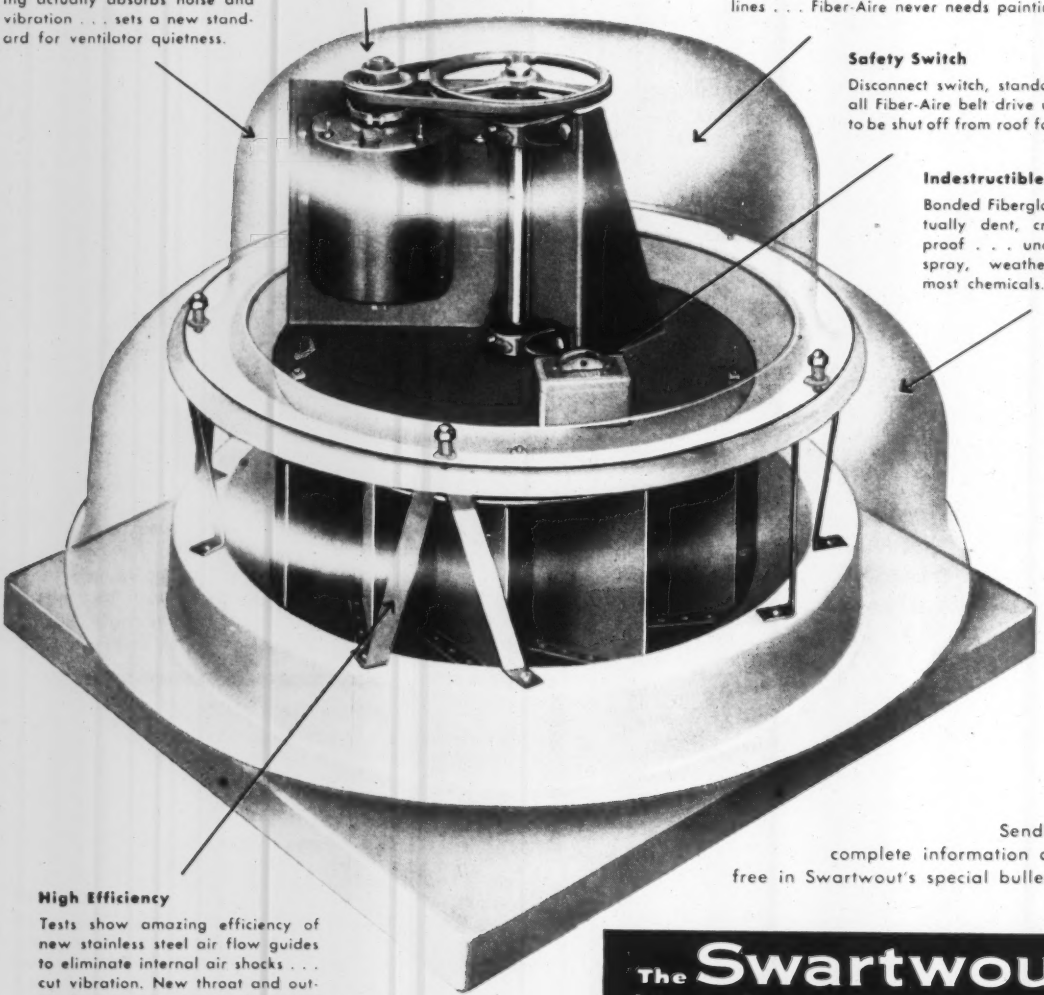
New Belt Drive "Fiber-Aires" with Bonded Fiberglas Housing*

Available now in 44 belt drive models
plus 17 direct drive units together providing capacities from 180 to 13,500 C.F.M.

Super Quiet
Fiber-Aire's all Fiberglas housing actually absorbs noise and vibration . . . sets a new standard for ventilator quietness.

Adjustable Capacity
Belt drive units feature easily adjustable sheaves . . . capacities are quickly changed, even after installation.

Flattering Design
Extra low contour and molded-in sky blue color, that "disappear" against the horizon, never mar clean architectural lines . . . Fiber-Aire never needs painting.



Safety Switch
Disconnect switch, standard equipment on all Fiber-Aire belt drive units, permits unit to be shut off from roof for absolute safety.

Indestructible
Bonded Fiberglas housing is virtually dent, crack and break proof . . . unaffected by salt spray, weather, fumes, and most chemicals.

High Efficiency
Tests show amazing efficiency of new stainless steel air flow guides to eliminate internal air shocks . . . cut vibration. New throat and outlet designs minimize loss from friction and turbulence.

Send now for complete information available free in Swartwout's special bulletin FA-2.

The Swartwout Co.
Ventilation Engineering
18568 Euclid Avenue Cleveland 12, Ohio

* TM Owens Corning Fiberglas Corporation

In Canada: Eastern Steel Products Ltd. 8 Bermondsey Road, Toronto, Ontario

WHO'S WHAT . . .

(New personnel, promotions)

▸ *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS*—Malcolm C. Reed, Dunkirk Radiator Corp., chairman; Daniel J. Quinn, American-Standard, vice chairman; Robert E. Ferry, secretary treasurer, I-B-R general manager; Executive Board; T. L. Arnold, Fedders-Quigan Corp.; R. H. Bohr, Federal Boiler Co., Inc., V. A. Good, Burnham Corp.; F. S. Hudson, Jr., National-U. S. Radiator Corp.; H. E. Kritzer, Kritzer Radiant Coils; M. Lundgren, Vulcan Radiator Co.; M. J. Murray, John J. Nesbitt, Inc.; R. G. Pinkerton, Peerless Heater Co.; S. K. Smith, H. B. Smith Co., Inc.; E. R. Westphal, Weil-McLain Co.

▸ *WORTHINGTON CORP.*—George F. Habach, vice president — administration; Rear Admiral (Ret.) Albert G. Mumma, vice president — engineering.

▸ *CARRIER CORP.*—Frank R. Littlefield, vice president, director of manufacturing; Walter H. Steitler, vice president, director of marketing; Walter A. Grant, director of engineering; C. A. Nolph, sales manager of military equipment in Machinery and Systems Div.

▸ *CRANE CO.*—Wesley A. Songer, executive vice president; John P. Kinnane, general manager of export sales; Ronald W. Lindsay, director of sales; Joseph A. Donahue, manager of sales promotion; W. D. LaRue, general manager of wholesaler sales.

▸ *SOCIETY OF PROFESSIONAL ENGINEERS*—Ed Mittendorf, president of Central Virginia Section. Mr. Mittendorf is Supt. of Bldg. and Grounds with the University of Virginia.

▸ *TRANE CO.*—William C. Dackis and William D. Graham, Jr., to vice presidents in sales division; John D. Cantwell, vice president, La Crosse manufacturing.

▸ *BABCOCK & WILCOX CO.*—John G. Martin, domestic sales manager, boiler division.

▸ *BURNS & ROE, INC.*—Alexander Matiuk, vice president and director of engineering.

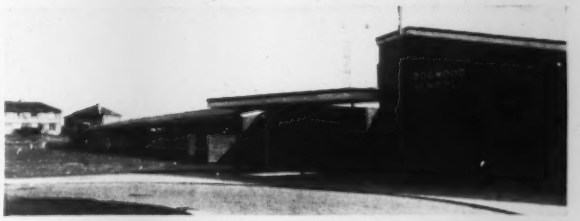
▸ *HEIL PROCESS EQUIPMENT CORP.*—Edwin W. Vereeke, president; Carl E. Heil, chairman board of directors.

▸ *BORG-WARNER CORP., YORK DIV.*—Kenneth J. Thompson and Henry H. Kirkpatrick, Jr., sales promotion managers; J. Donald Smith, advertising manager;

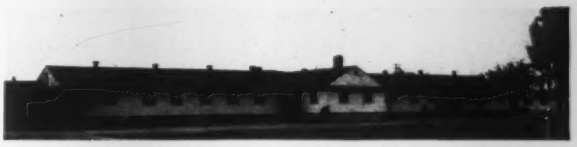
LARGE OR SMALL

LO-BLAST

POWER GAS BURNERS
COST LESS TO OPERATE



Low cost installation and operation dictated Lo-BLAST selection in this modern school.



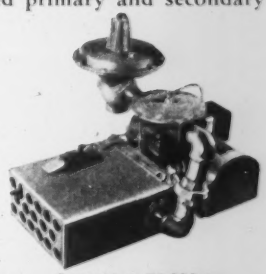
Sixteen Lo-BLAST Burners at this army camp burn 30,000 cu. ft./hr. of gas when all are operating.

In this development of 472 small homes, Lo-BLAST Economite Burners replaced oil burners originally installed.

Lo-BLAST Burners cost on an average of 10% less to operate. They use an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air from start to finish of each run. Operation is always independent of natural draft conditions—ideal for down draft boilers.

Cost less to install

Lo-BLAST Burners eliminate the need for high chimneys—inshot design and complete factory assembly reduce maintenance and installation costs. Each unit is factory tested on gas before shipment.



Capacities: 75,000 to 20,000,000 BTU/hr. input.

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METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

DO YOU FIND YOUR PUMP PROBLEM HERE?

A Water Supply
Air Conditioning
Refrigeration
Cooling Towers
Sump Pumping, Etc.

B Booster Service
Cooling Towers
Water Treatment
Water Circulation
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C Hot Water Circulation
Ice Water or Brine
Clear Water
Boilers
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D Hot and Cold Liquids
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Boiler Feed
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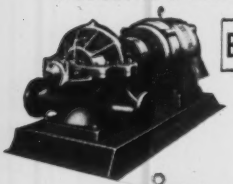
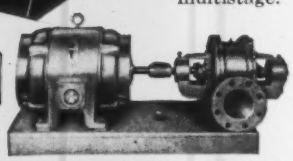
Then You'll Find Your Best Answer Here—

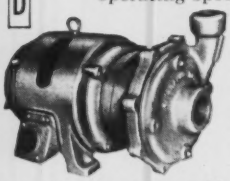
A **F-M Pomona Water-Lubricated Turbine Pumps**
Easily installed, easy to adjust for varying field conditions. Available with wide choice of drivers.



B **F-M Split-Case Centrifugal Pumps**
Capacities, pressures and sizes for any requirements. Single-stage or multistage.



C **F-M Westco Peripheral Pumps**
Capacities to 200 gpm. Pressures to 900 ft. Sizes 1½" through 2½". Horizontal single-stage or multistage. Develops high pressure at normal operating speeds.



D **F-M Builtogether Centrifugal Pumps**
Capacities to 900 gpm. Pressures to 525 ft. Sizes ¾" through 5". Single-stage or multistage.

FREE! Expert Engineering Help at Your Service

Be *sure* of low-cost, foolproof pumping installations that match your exact requirements... call in your Fairbanks-Morse Sales Engineer. Take advantage of his broad technical background and expert knowledge of pumps for air conditioning, plumbing and heating. Call him today, or write Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Illinois.

See Sweet's Product Design Catalog File for complete F-M Pump Line.

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a name worth remembering when you want the BEST

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY
RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

WHO'S WHAT

Continued

Caron N. Ehehalt, manager of advertising and sales promotion services.

▸ *TUBE TURNS PLASTICS, INC.*—Carl B. McLaughlin, president. He has been executive vice president since the company was founded in 1954.

▸ *PLUMBING-HEATING-COOLING INFORMATION BUREAU*—W. T. Halket, member of board of directors. Mr. Halket is director of marketing, Permaglas Div., A. O. Smith Corp.

▸ *AIR REDUCTION SALES CO.*—E. S. Twining, Jr., vice president — marketing; G. L. Weley, Jr., manager, gas department — marketing.

▸ *DETROIT STOKER CO.*—Herbert L. Wagner, president; Ellery C. Huntington, Jr., chairman of board; David A. Dawn, vice president; A. Edwin Fein, secretary; Herbert M. Weil, treasurer.

▸ *OLIN MATHIESON CHEMICAL CORP.*—R. H. Benedict, Jr., sales manager for Ramset Fastening System, Cleveland.

▸ *FAIRBANKS, MORSE & CO.*—Robert W. Kerr, president; Robert H. Morse, Jr., vice chairman of board; Frank H. Cankar, vice president — administration; William S. Schwab and Delmar W. Holloman, assistant secretaries.

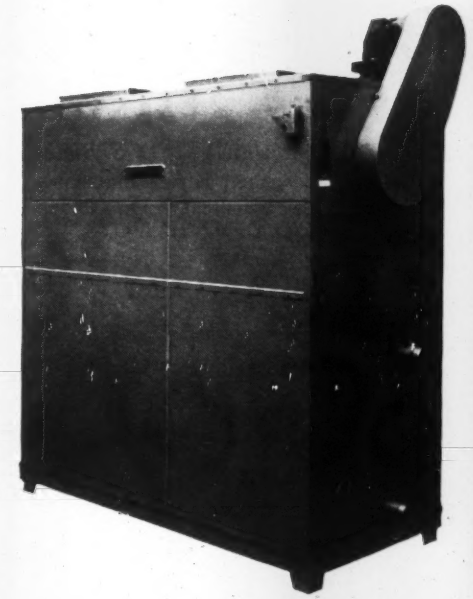
▸ *JANITROL HEATING & AIR CONDITIONING DIV. of SURFACE COMBUSTION CORP.*—John I. Trimble, general manager.

▸ *JENKINS BROS.*—Louis A. Muller, assistant general sales manager.

▸ *FLEXONICS CORP.*—Robert M. Quick, division marketing manager.

▸ *RESEARCH PRODUCTS CORP.*—John G. Schutz, general sales manager; E. F. Rothe, assistant general sales manager; K. H. Lindquist, administrative assistant; A. H. Hambrecht, production manager; Jerry Staebell, traffic manager; Howard Hoveland, purchasing agent.

▸ *CUTLER-HAMMER, INC.*—W. E. Addicks, retiring sales executive succeeded by E. E. Durham of Cleveland sales area; R. A. Haworth, apparatus sales manager.



Another *Quality* *First* for *Marlo*

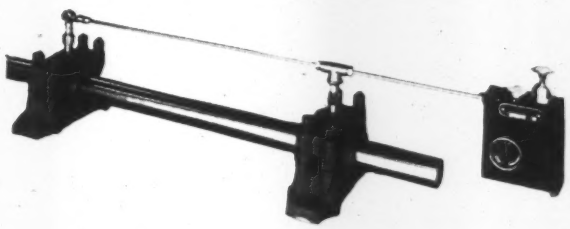
THE SIMPLE PULL OF A PLUNGER LUBRICATES ALL BEARINGS SIMULTANEOUSLY ON AIR CONDITIONING AND REFRIGERATION EQUIPMENT

Centralized lubrication, used extensively on the finest machine tools, is now applied to air conditioning and refrigeration equipment for the first time.

On all Marlo sleeve-bearing units, a single operation—the simple pull of a plunger—shoots a measured amount of lubricant at 30 psi to every bearing simultaneously. Maintenance is simplified and reduced, guesswork and human error eliminated. And because the system is sealed and filter-equipped, no foreign matter can reach bearings.

Reservoir equipped with oil level sight glass has a capacity of 60 or 150 cc of lubricant (depending on size of the Marlo unit)—enough for 60 or 75 "shots".

Specify Marlo units equipped with a closed forced feed lubrication system, metering oil to each bearing from a central lubrication point with oil reservoir and sight glass.



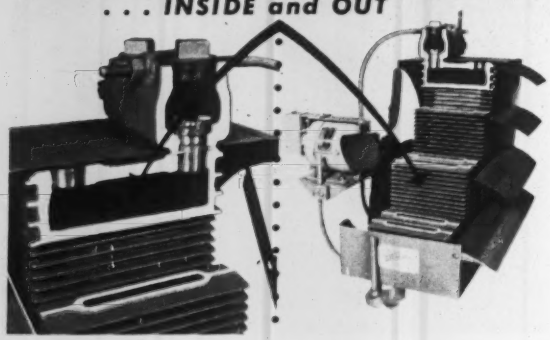
Marlo coil co.

SAINT LOUIS 11, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

it's the material that makes the difference . . .

. . . INSIDE and OUT



CORROSION causes heating equipment failures!

BUT NOT WHEN YOU USE

GRID

cast iron construction

- UNIT HEATERS
- BLAST HEATERS
- RADIATORS

Designed for operation on steam pressure up to 250 PSI 450° temperature

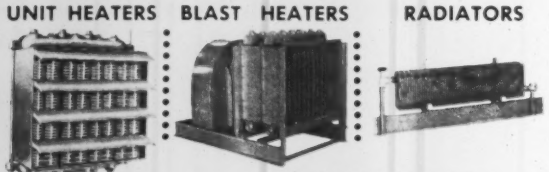
CORROSION internally, caused by electrolytic action as in copper tubes, can't happen in GRID's cast iron steam chambers and headers. Nor can acid condensate corrode the bottom connections. Cast Iron, internally, resists corrosion.

CORROSION externally, caused by acid fumes cannot destroy GRID's cast iron finned heating surface. Widely spaced fins cast integral with the steam chamber will not corrode externally.

ORDINARY HEATING SURFACES FAIL BECAUSE OF CORROSION INSIDE AND OUT! AVOID THESE COSTLY HEATING FAILURES!

Send for Catalog 956 . . . The complete story on Grid Unit Heaters, Blast Heaters and Radiators.

UNIT HEATERS BLAST HEATERS RADIATORS



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D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883

WAUSAU, WISCONSIN

OFFICES IN PRINCIPAL CITIES

WHO'S WHAT

Continued

▶ *BARNEBEY-CHENEY CO.*—Robert Giesecke, to handle charcoal sales overseas; Donald R. Lee, sales engineer.

▶ *AMERICAN-STANDARD, INDUSTRIAL DIV.*—C. K. Ferguson, manager, advertising and sales promotion; Richard C. Habicht, product manager in charge of special packaged products department.

▶ *WALWORTH CO.*—Charles H. Creasser, vice president in charge of manufacturing.

▶ *YOUNG RADIATOR CO.*—J. J. Hilt, vice president, sales.

▶ *JOHNSON SERVICE CO.*—Stephen T. Hagerman, manager international division.

▶ *ARMCO STEEL CORP.*—W. W. Sebald, retiring from all active duties, but remaining as a director on company's board.

▶ *CENTURY ELECTRIC CO.*—William Eric Mier, export manager.

▶ *KEASBEY & MATTISON CO.*—John R. Purtell, sales service supervisor; Lawrence J. Clark, systems and procedures manager.

▶ *WESTINGHOUSE ELECTRIC CORP.*—Robert W. Ayling, engineering section manager, large compressors, in company's air conditioning division.

▶ *E. I. du PONT de NEMOURS & CO., INC.*—Russell C. Weigel, assistant general manager of polychemicals department, elected president and director.

▶ *ANSUL CHEMICAL CO.*—John K. Worthington and James L. Maurer, representatives.

▶ *WORTHINGTON CORP.*—A. James Hackl, general manager of air conditioning and refrigeration division.

▶ *OIL HEAT INSTITUTE OF AMERICA*—Robert J. Griffin, manager of field services.

▶ *ACME STEEL CO.*—Alfred M. Frederick, assistant advertising manager of advertising and sales promotion department.

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When your projects call for a smokestack, you can specify a Van-Packer Model HT Prefabricated Refractory Smokestack knowing that it lives up to the high standards required to earn an Underwriters' Laboratories listing.

The Van-Packer Model HT Smokestack for boilers, furnaces, and incinerators is the *only* UL listed stack. It is the same stack for industrial applications that is already serving hundreds of users throughout the nation with these advantages: low cost, prefabricated refractory construction, maintenance-free, high draft, stocked in eight diameters nationally.

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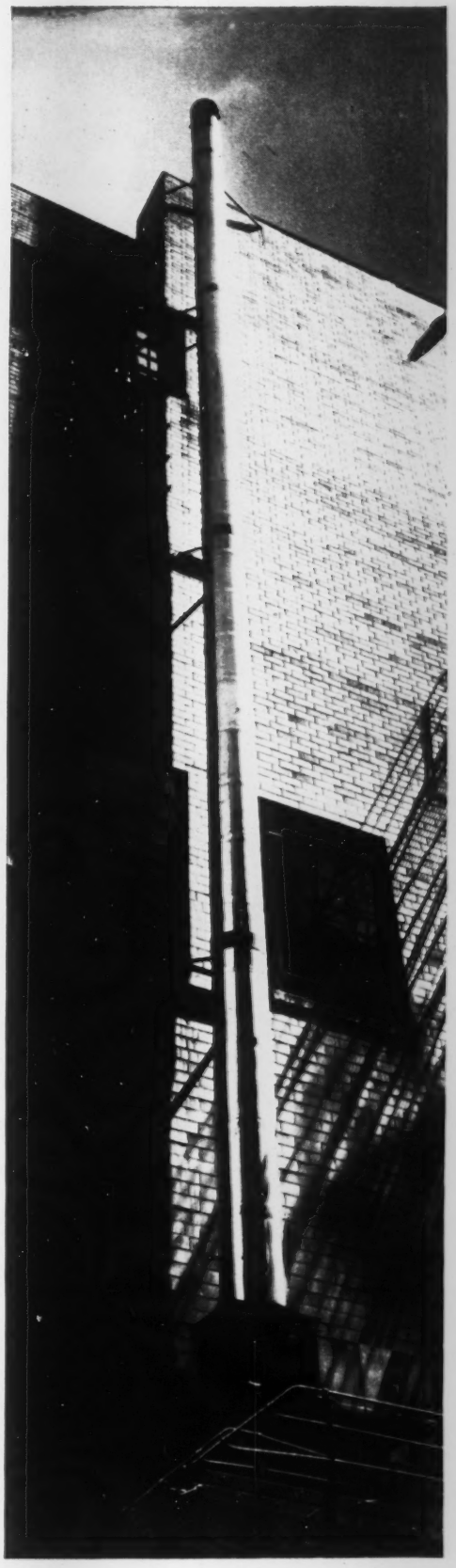
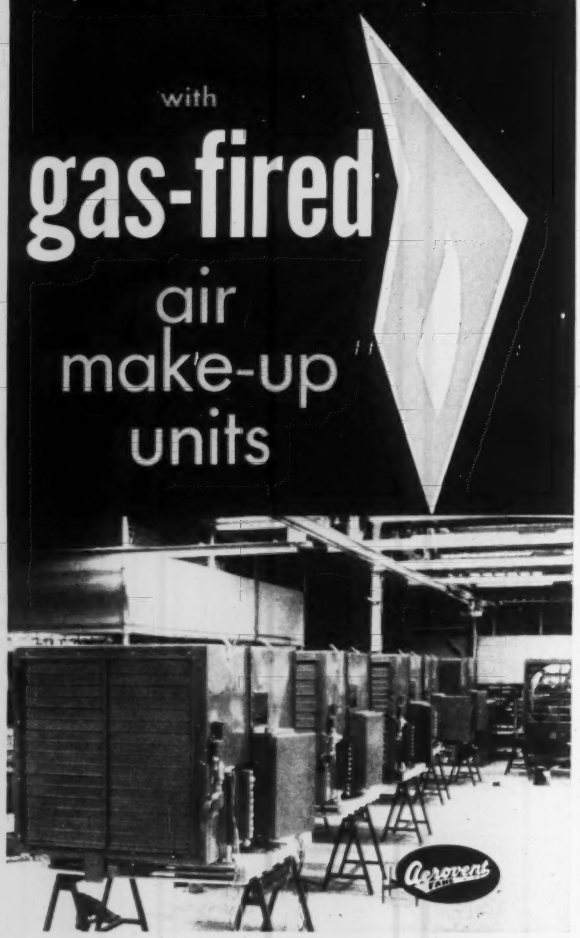


increase production capacity . . .
improve fan and heating efficiency

with

gas-fired
air
make-up
units



Pictured above is a portion of the final assembly line at Aerovent showing 8 units slated for delivery to a large Midwestern automobile accessory manufacturing plant. Designed to supply ample quantities of clean, pre-heated or cool, outside air to replace air exhausted by ventilating systems, the Aerovent Gas-Fired Air Make-Up Unit keeps air fresh; eliminates drafts and negative pressures. Safe, dependable operation and automatic, semi-automatic or manual control with natural, mixed, manufactured or propane gas.

For winter or summer use, these compact, packaged units are available in four unit arrangements and four sizes from 36" to 54" for various capacities, BTU ratings and pressure conditions.

Write for bulletin 880.

OTHER UNITS AVAILABLE FOR STEAM OR HOT WATER

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent
FAN COMPANY, INC.
Ash and Branch Streets — Piqua, Ohio

WHO'S WHAT

Continued

▸ *OLIN MATHIESON CHEMICAL CORP.*—John P. Andersen, assistant manager of aluminum distributor sales.

▸ *TACO HEATERS, INC.*—Robert F. Elliott, sales representative, national accounts.

▸ *JAMESBURY CORP.*—Eric W. Essen, sales coordinator; Robert L. Fraser, assistant sales coordinator.

▸ *J. E. LONERGAN CO.*—William A. Roach, Jr., product manager.

▸ *HENRY VALVE CO.*—Robert W. Carvell, sales promotion and advertising manager.

▸ *AMERICAN GAS ASSOCIATION*—Edgar A. Jahn, assistant director of utilization bureau.

▸ *W. D. ALLEN MFG. CO.*—John Searfoss, manager of fire protection equipment department; Marshall P. Jepson, sales manager of manufacturing division.

▸ *LOGAN CLAY PRODUCTS CO.*—Richard H. Holl, vice president, sales.

▸ *AMERICAN-STANDARD, INDUSTRIAL DIV.*—J. W. Hosler, marketing manager for "Kewanee" and "Nesbitt" product lines; R. A. Loebl, air conditioning products marketing manager; H. C. Grubb, product manager for centrifugal refrigeration compressors.

▸ *MUELLER BRASS CO.*—Vincent A. Bower, manager of wholesale distributing division.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *CHEMETRON CORP.*—Charleston Supply Co., distributor in Charleston, S. C.; C. S. Mersick Co., distributor in New Haven, Conn.; National Plumbing & Heating Supply Co., distributor in Providence, R. I.; New Hampshire Supply Co., distributor in Manchester, N. H.; Raritan Supply Co., distributor in Nixon, N. J.; John Day Rubber & Supply Co., distributor in Omaha, Neb.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Edward J. Klein, Mid-Atlantic regional industrial manager; John J. Horner, industrial manager of Philadelphia branch office; Carl F. Boehnlein, industrial

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196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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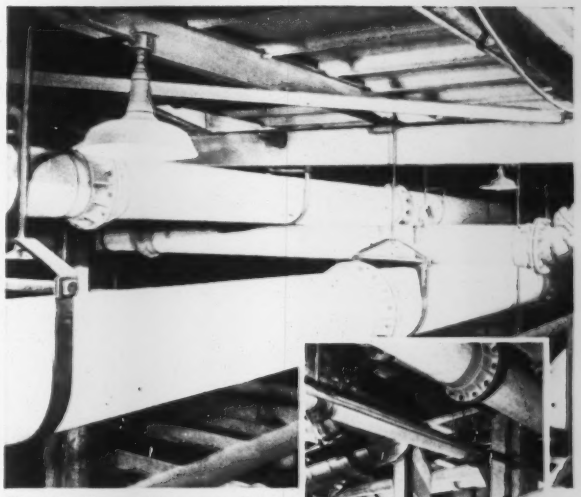
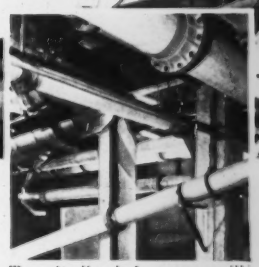


Transite Pipe performs nine different services in the St. Regis Company's Jacksonville Plant.



Transite line is from new mill washed stock chest to old mill washed stock chest.

Transite Pipe helps St. Regis work giant new "Seminole Chief" at full capacity!

Chief Engineer, L. C. Crowder, tells of experience with Transite . . . how its flow capacity and "cleanliness" determined its selection

Almost by the day, we see new reports on the added economy and performance that Transite® Pipe brings to water and stock lines. One such report comes to us from the St. Regis Company's Jacksonville Plant:

"When we recently installed the Seminole Chief, one of the largest capacity machines in the industry," says Mr. Crowder, Chief Engineer, Pulp & Paper Division, "production jumped from 300 to 1300 tons per day. And water capacity and stock cleanliness became more important than ever.

"Six years' experience with Transite Pipe told us it would do the job. It has an exceptionally smooth interior surface that offers minimum frictional resistance to the flow of liquids. Of equal importance, it is immune to tuberculation and is resistant to sliming and bacterial growths.

"For all those reasons we chose Transite Pipe for our entire system. Carrying water and stock in nine different types of lines, Transite helps us maintain an even and continual flow rate . . . with required stock cleanliness."

Proven installation economy, maintenance savings and resistance to stock build-up—make Transite Pipe well worth your investigation. Meanwhile, let us send you copies of TR-113A, a 24-page illustrated brochure and TR-180A, the Transite installation guide for process systems. Send for them today. Address Johns-Manville, Box 147A, New York 16, N.Y.

JM

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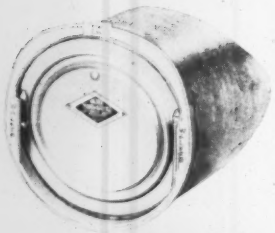
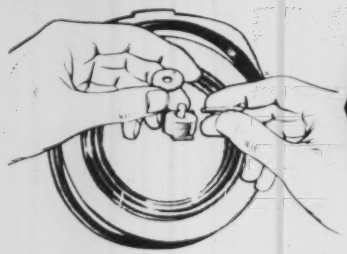
IMPROVED *Pre-Balanced* draft regulator





...with NEW *"Pick-off"* vane adjustment!

WALKER
34 (Balanced)
DRAFT REGULATOR

• Even more sensitive and dependable than its famous forerunner, the Type 34, this *improved* model, WALKER BALANCED TYPE 34, is *pre*-balanced — *at the factory* — for perfect sensitivity to draft variations. And the BALANCED 34 *stays* balanced — *permanently!*

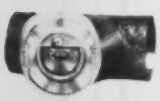
The new *"Pick-Off" Draft Adjustment* makes precision setting of the BALANCED 34 as easy as picking up a stack of coins! Just pull out cotter pin (above) and add or remove as many pick-off counterweight discs as needed to set the BALANCED 34 exactly for particular draft conditions. *No moving parts to corrode or jam, so unit is always easy to adjust. The WALKER BALANCED TYPE 34 gives you finer, foolproof adjustment to closer limits over a wider range!*

The BALANCED 34 also boasts handsome, newly designed frame, improved gate stop to soften closure noise, and enclosed knife-edge life-time pivots.

CHECK THESE BALANCED-34 FEATURES:

- **Pre**-balanced damper for precise equilibrium, maximum sensivity to draft change.
- New "Pick-Off" adjustment for fast, fine, foolproof, wide-range setting.
- No moving parts to corrode or jam.
- Enclosed knife-edge pivots for life-long sensitive service.
- Heat- and corrosion-resistant vane of finest aluminized steel.
- Improved vane-stop to soften closure noise.
- Newly designed light, durable aluminum frame.

WRITE TO WALKER NOW at the address below for full details on the new BALANCED 34 and for full catalog of WALKER Draft Control products.



ROYAL PURPLE Regulator for smaller central heating plants

SHUR-FLO Inducer-Regulator for gas, oil and solid-fuel plants

JUNIOR LINE for central heating budget control

TYPE BB commercial and industrial control

DOUBLE SWING for gas-fired equipment

VENTURI CAP for heating and ventilating

WALKER MANUFACTURING AND SALES CORP. 1720 Penn St., St. Joseph, Mo.

WHO'S WHAT

Continued

manager of Richmond, Va. branch office; J. A. DePuy, central regional manager.

▶ *A. M. BYERS CO.*—Gerald L. Jensen, field service engineer for Pacific Northwest; new distributors include: Norvell-Wilder Supply Co., Shreveport, La.; Hudson Nipple Mfg. Co., Brooklyn, N. Y.; J. R. Detering Co., Sacramento, Calif.

▶ *YEOMANS BROS. CO.*—Frank J. Smith, in charge of new New York direct factory sales office serving same areas of New York and New Jersey.

▶ *CAMBRIDGE FILTER CORP.*—Havesco, Inc., representative covering Greater New York area; Associated Air Products, representative in northern New Jersey; Vernon S. Tupper Co., representative in central Tennessee area; Flinn Engineering Co., representative for western Tennessee, State of Arkansas and northern half of Mississippi; W. O. Chrissinger Co., representative in Columbus, Ohio area; Consolidated Supply Co., Inc., representative in State of Maryland; Gary G. Schultz & Assoc., covering Dayton, Ohio area.

▶ *ACME INDUSTRIES, INC.*—New Ohio branch at 2386 E. 290th St., Wickliffe, Ohio to serve Cleveland-Akron area; new Detroit office at 18450 Livernois Ave. to service local area and supervise sales engineering activity in Michigan, Ohio, Kentucky, West Virginia, Ontario, and part of New York and Pennsylvania.

▶ *DRAVO CORP.*—Frederick W. Schulte, St. Louis district manager for Engineering Works division.

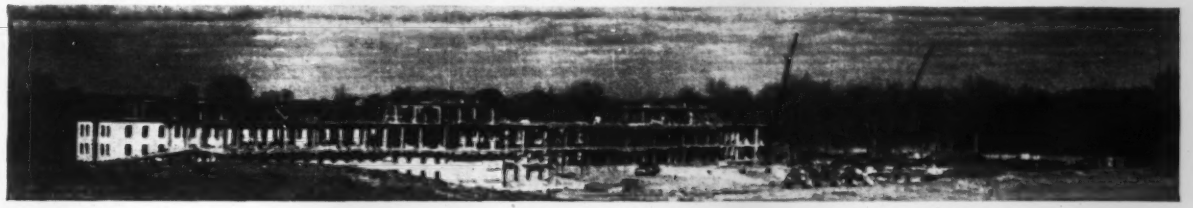
▶ *TRANE CO.*—Joe Wharton, manager of sales office at Lubbock, Texas.

▶ *BABCOCK & WILCOX CO.*—William E. Butler, manager of Cincinnati district sales office; Ralph K. Behr, manager of New York district sales office, Boiler Div.; Gerald S. White, manager Boston district sales office, Boiler Div.

▶ *ILG ELECTRIC VENTILATING CO.*—J. W. Hamrick, Jr., salesman with New Orleans office; Roger F. Wirant, sales engineer with Pittsburgh office.

▶ *KEASBEY & MATTISON CO.*—M. E. Fuller, assistant district manager in San Francisco.

The Esso Research Center's 3-story, 600-ft.-long office building includes conference rooms, technical library, correlations and computer center, medical department, cafeteria and landscaped court for its 800 employees. The project was designed and engineered by Voorhees Walker Smith Smith and Haines of New York City. Frank Briscoe, Inc., Newark N. J., is general contractor. August Arace & Son, Inc., Elizabeth, N. J., is mechanical contractor for heating and air conditioning. Alward Construction Co., Bernardsville, N. J., is doing the insulation work.



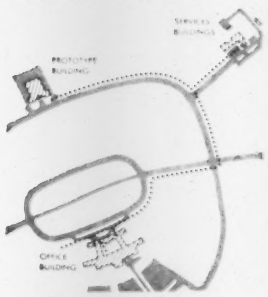
Esso Research Center uses GILSULATE® for insulating mile of underground steam pipes

GILSULATE goes in fast. In the foreground the field inspector checks depth of pour. Directly in back of him, two workmen are shovelpointing and tamping. Other workers are sliding GILSULATE bags into pipe trench while men at rear are placing plywood forms near manhole.

Esso Research and Engineering Company, the scientific and engineering affiliate of Standard Oil Company of New Jersey, is now constructing a modern research center in Florham Park, N. J. To preserve the natural beauty of the 675-acre site, all heating, air conditioning, power and communications lines are run underground.

Steam, at a pressure of 250 lbs. (406° F.), will flow through a 600-ft.-long, 12" welded steel pipe from the boiler room to a manhole where a 1400-ft. string of 10", 8" and 6" pipe will carry heat to the prototype building. Similar piping leaves the other side of the first manhole and runs 2500 feet to the main office building. Trenches also carry 3" to 6" condensate return lines. The system has 24 expansion loops and seven manholes, and includes capped lines for use when facilities are expanded.

Over 500 tons of GILSULATE will be used for insulating and protecting the underground steam pipes. In addition to its low thermal conductivity, GILSULATE resists attack by acids, alkalies and electrical conductivity and provides excellent protection against corrosion. For full information on this low-cost, poured-in-place insulation, see your local GILSULATE distributor, or write our Salt Lake City office.



FACTS ABOUT GILSULATE

1. **EASY TO USE** - just pour, shovelpoint and tamp... pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by buried hot pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220-300° F. temp. range
   Type B for 300-385° F. temp. range
   Type C for 385-520° F. temp. range

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF UNDERGROUND HOT PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY

Affiliate of Barber Oil Corp. & Standard Oil Co. of California
Offices at: Municipal Airport P.O. Box 15, Salt Lake City, Utah
3537 Lee Road, Cleveland 20, Ohio
Distributors in Principal Countries of the World

Do you receive Pipe Insulation News? Ask to be put on our mailing list.

WHO'S WHAT

Continued

▸ *FLEXONICS CORP.*—Robert Barnum, district sales manager of Los Angeles district.

▸ *RAYPAK CO., INC.*—Richard M. Norton, special assistant to general sales manager to cover manufacturers' representatives internationally.

▸ *OAKITE PRODUCTS, INC.*—Ben P. Fortin to field service organization in Los Angeles; J. G. Hickey to Sacramento, Calif.; Wayland E. White to Corpus Christi territory.

▸ *YOUNG RADIATOR CO.*—F. E. Tapy, manufacturers' representative for State of Nebraska and western section of Iowa.

▸ *INSUL CHEMICAL CO.*—Ralph D. Moore, sales representative at Oakland, Calif. to serve State of California from Fresno north and Reno, Nevada; new refrigeration warehouse in Oakland to cover same territory; John K. Worthington and James L. Maurer, sales representatives to share sales region of Minnesota, eastern Iowa, Illinois, Indiana, North and South Dakota.

▸ *CLEAVER-BROOKS CO.*—Thomas B. Mansfield and Richard D. Pennstrom, midwest and northeastern regional managers, respectively.

▸ *MUELLER BRASS CO.*—John R. Rinkevich, sales representative to Denver office.

▸ *ALLIS-CHALMERS MFG. CO.*—W. Robert Greer, Pittsburgh district sales representative; Thomas A. Poulos, sales representative for Philadelphia district; Joseph L. Huprich, service representative for Mid-Atlantic region; A. Hart Grundy, Jr., and John W. McNeil, sales representatives for Richmond district; Charles H. Honeycutt, sales representative, Charlotte district.

▸ *CUTLER-HAMMER, INC.*—T. R. Christian, Atlanta district manager; K. L. Smith, Kansas City district manager; K. A. Krug, Grand Rapids district manager.

▸ *C. H. WHEELER MFG. CO.*—Charles A. McKeen, sales engineer in Chicago office of Economy Pump Div.

▸ *DRESSER MFG. DIV., DRESSER INDUSTRIES*—William A. Rosendale, sales representative covering metropolitan New York. ≠

RAYPAK TRI-TEMP SYSTEM

THE PACKAGE HOT WATER SYSTEM
FOR THE FOOD SERVING INDUSTRY.

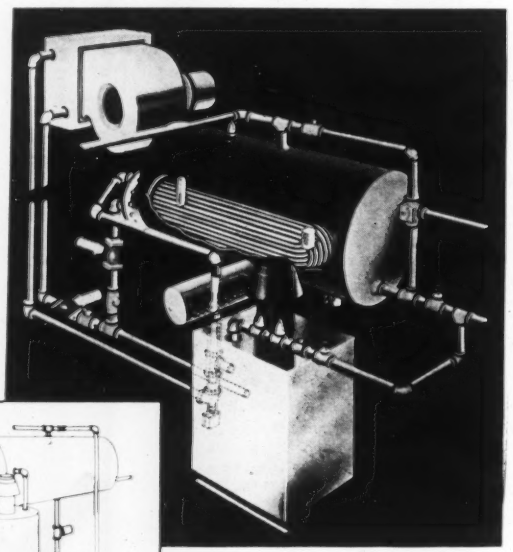
Provides water at **200°** *for space heating,*
180° *for sanitary rinse,*
140° *for general purpose*

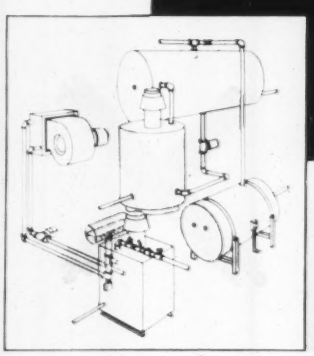
from a single **RAYPAK** *gas fired boiler*

Saves up to 40% in original equipment and installation costs – slashes maintenance expense – a superior indirect system – Raypak boiler guaranteed for 20 years.

As only one boiler, one vent and one gas line are required there are important savings in equipment and installation costs. The Tri-Temp System saves a great deal of space, an important factor in the food serving business. The Raypak Tri-Temp System is available in a wide range of sizes and capacities.

The Raypak Dual-Temp System is identical to the Tri-Temp System and is available for installations where there already exists central heating.





In the old style system a much larger storage tank wastes space and doubles cost. The obsolete method directly heats raw main water with resultant scaling and corrosion, with extremely high maintenance and replacement expense on the water heater and high temperature booster.

Raypak® **COMPANY, INC.**
Engineers-Manufacturers **2416 CHICO AVENUE, EL MONTE, CALIFORNIA**

5 OUTSTANDING EXCLUSIVE ADVANTAGES IN THE REVOLUTIONARY NEW

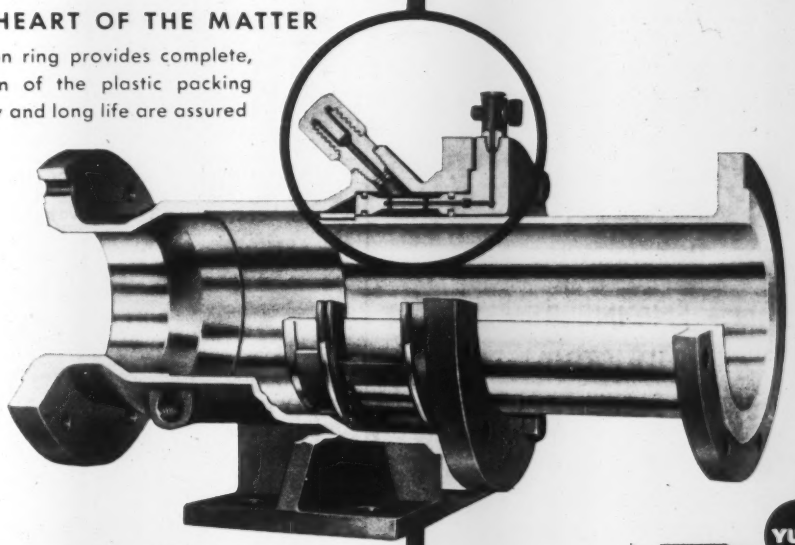
ADSCO RAM-PAK EXPANSION JOINTS

The 5 advantages are: One-point lubrication; 2) *complete* and *uniform* lubrication of the packing assured by the lubricant dispersion ring; 3) removable packing chamber permits replacement of packing without removing expansion joints from the line; 4) rugged outward limit stop is provided by internal guide and, in addition, an outer guide is provided; 5) support base conforms in all respects to A. S. A. standards.

RAM-PAK was designed by ADSCO, the oldest and largest manufacturer of expansion joints in the world. ADSCO invented the first expansion joint in 1877, since then has given the heating industry many great advancements, including the famous Piston-Ring Expansion Joint. Now, in the RAM-PAK, ADSCO offers engineers a high performance, economical, entirely new expansion joint which is unbelievably ingenious in construction. Write for complete information.

HERE'S THE HEART OF THE MATTER

Lubricant dispersion ring provides complete, uniform lubrication of the plastic packing material. Resiliency and long life are assured



ADSCO DIVISION

World's Oldest and Largest Manufacturer of Expansion Joints

20 MILBURN ST., BUFFALO 12, N. Y.

YUBA

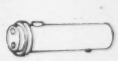
YUBA CONSOLIDATED INDUSTRIES, INC.

Plants and Sales Offices

Other Adsco Products for the Heating Industry

Corruflex Packless Expansion Joints

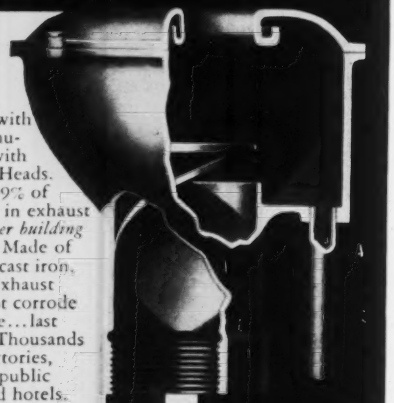
Alignment Guides



Instantaneous Heaters

Storage Water Heaters

Swartwout
EXHAUST HEADS
slash building maintenance cost



Prevent the ravages of water and oil in exhaust steam during warm weather...do away with ice and grime accumulations in winter—with Swartwout Exhaust Heads. They remove over 99% of moisture and oil in exhaust steam—*for lower building maintenance.* Made of long-lasting cast iron, Swartwout Exhaust Heads do not corrode or deteriorate...last indefinitely. Thousands in use on factories, institutions, public buildings and hotels. Many still in use even after *50 years continuous service.*

Available from your industrial distributor or from The Swartwout Company. For exhaust pipes from 1 to 30" in diameter. Write for free Bulletin S-16-C.

Cutaway section shows exclusive helico-centrifugal principle that prevents back pressure. Swartwout Exhaust Heads blend in with modern or classic architecture, actually enhance building appearance.

The Swartwout Company
18511 EUCLID AVE. • CLEVELAND 12, OHIO

"Who Makes It?"
"Where Can We Get It?"

FOR THEIR ANSWERS

CONSULTING ENGINEERS
ENGINEERS IN INDUSTRIAL PLANTS
ENGINEERS IN LARGE BUILDINGS
&
MECHANICAL CONTRACTORS

GO TO THE *BIG* ANNUAL

Heating, Piping & Air Conditioning January Directory Number

Start Making *Your* Plans Now For Adequate Space In The January 1960 Issue

WE HEAR THAT...

▸ *EHRET MAGNESIA MFG. CO.* and *BALDWIN-HILL CO.* have announced plans for a merger. If approved by stockholders, the merger would become effective this month.

▸ *HARRY J. CLARK* has terminated his connection with the heating and air conditioning division of *MODINE MFG. CO.* in order to form *HAVCO, INC.* with two associates, *SIDNEY L. GAYLE* and *HARRY A. KING.* Havco will represent and handle the complete Modine line of heating and air conditioning equipment in the New York City sales territory.

▸ *AEROQUIP CORP.* has begun a $2.4 million expansion program to provide a total of 140,000 sq ft of additional working area. The project is scheduled for the next 18 months.

▸ *AIR-MAZE CORP.* has been acquired by *ROCKWELL-STANDARD CORP.* It will operate as a subsidiary of Rockwell-Standard and will continue its present policies.

▸ *HEIN-WERNER CORP.* has begun a $175 million addition to its Waukesha, Wis., plant which will increase facilities by 15 percent.

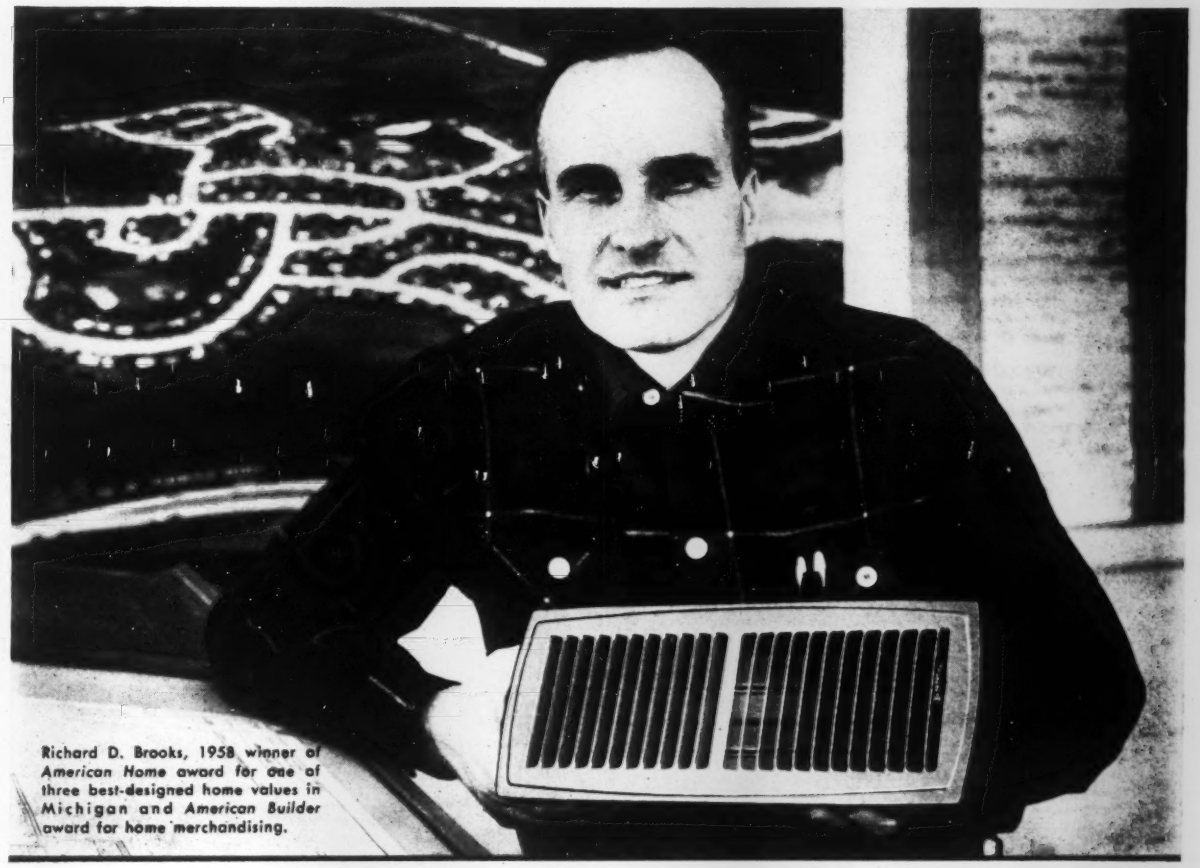
▸ *AIR REDUCTION CO., INC.* announced plans for a test laboratory in Franklin Township, N. J. The new laboratory will be devoted to research on fuels and oxidizers. Completion of the new installation is expected by late summer.

▸ A $17 million expansion program has been begun by the *ARMCO DIV.* of *ARMCO STEEL CORP.* Work will start later this year and the entire project is scheduled for completion in late 1960.

▸ *LIMBACH CO.* recently broke ground for its new Cincinnati headquarters office building and fabricating plant. The facility will include 8000 sq ft of office space and 26,000 sq ft of plant area. Completion is expected in late September.

▸ *VOSS BELTING & SPECIALTY CO.* recently announced the formation of *VOSS ENGINEERING, INC.* The new company, located at 5649 N. Ravenswood Ave., Chicago, will specialize in the manufacture and distribution of vibration and shock controls for machinery.

"VALUES LIKE THIS HAVE BUILT OUR BUSINESS"

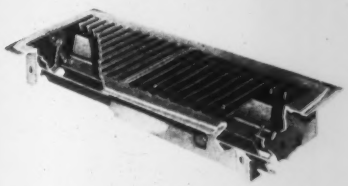


Richard D. Brooks, 1958 winner of *American Home* award for one of three best-designed home values in Michigan and *American Builder* award for home merchandising.

How Air Control's No. 150 Economy Floor Diffuser Helps Sell Custom-Built Homes

R. D. Brooks sells more custom-built homes than any other builder in the Grand Rapids, Michigan area. As many as 100 per year! He can offer custom housing at unusually attractive prices because he and his sub-contractors know the importance of selective purchasing.

Dick Brooks likes Air Control's new No. 150 Economy Floor Diffuser because it offers features found only in the most expensive models, yet permits his heating contractor to help him hold the price line. "This is truly an outstanding value," Dick reports. "Everything about it is in perfect harmony with our reputation for custom-quality homes at downright reasonable prices."



IDEAL FOR PROJECTS, TOO

The **low, low price** of the new No. 150 really lets you sharpen your pencil for project bids. Yet it has **exclusive expansion tabs** for snug fit in rough-cut openings, **opposed-action valve** on 4" widths, special **tension springs** for rattle-free operation, **lockable volume setting, Adjusto-Stop,** adjustable **factory-set vanes, long-wearing finish.**

Write for catalog.

359 Center Street

Air Control
PRODUCTS, INC.

Coopersville, Michigan

YOU CAN BUY AIR FILTERS WITH CONFIDENCE FROM MEMBERS OF . . .

The Air Filter Institute

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Air-Maze Corporation
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Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 9, Kentucky

Continental Air Filters, Inc.
2520 Helm Street
Louisville, Kentucky

Dollinger Corporation
11 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Fram Corporation
Providence 16, Rhode Island

Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio

Pittsburgh Plate Glass Company
Fiber Glass Division
One Gateway Center
Pittsburgh 22, Pennsylvania

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

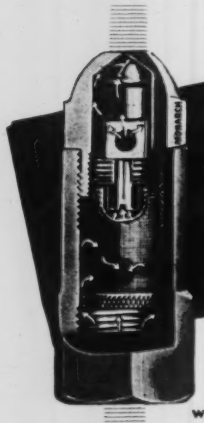
*Technical Filter Co.
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

Vortox Company
121 S. Alexander Avenue
Claremont, California

Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts

*Formerly Wilson & Co., Inc.



Monarch NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

WE HEAR THAT

Continued

▶ *HAYS MFG. CO.* is celebrating its 90th anniversary as a manufacturer of brass and iron stops, valves, and fittings, and many other products for gas, water, and manufacturing industries.

▶ *YOUNGSTOWN SHEET & TUBE CO.* broke ground for a new continuous annealing line at its Indiana Harbor Works No. 2 tin mill. Operation will begin in two years with a capacity four times that of the unit that went into production last year.

▶ A 40 percent increase in production is planned by *BARRY CONTROLS, INC.* as a result of current expansion at its Watertown, Mass., plant.

▶ *CHASE BRASS & COPPER CO.* is instituting major expansions and improvements in availability and packaging of valves and fittings for copper and brass pipe and tube by adding 200 new items.

▶ *ANDERSON PRODUCTS, INC.* recently moved to 34 Crafts St., Newtonville 60, Mass. The move will consolidate manufacturing, assembly, and sales at one location.

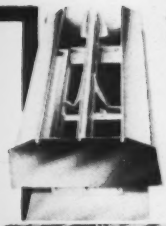
▶ *VANTON PUMP DIV.* of *COOPER ALLOY CORP.* has developed a new design service department. Prime function of the new facility will be to give detailed advice on specific fluid transfer problems.

▶ Plans for a new *CENTURY ELECTRIC CO.* plant to be built in McMinnville, Tenn., have been announced.

▶ Twenty-one graduates of U. S. and Canadian colleges and universities have completed *TRANE CO.'s* six-month specialized engineering program. The program is designed to prepare the graduate for his place in the air conditioning and heating industry through applications of engineering principles.

▶ A new sales office and warehouse has been opened by *WHITEHEAD METALS, INC.* in Syracuse, N. Y. The facility contains 40,000 sq ft of warehouse space and 5000 sq ft of office area.

▶ *ALBERT A. LIST*, president and chairman of the board of *GLEN ALDEN CORP.*, of which *THE MATHES CO.* is a division, recently donated a new four-story structure named in his honor to the New School for Social Research.

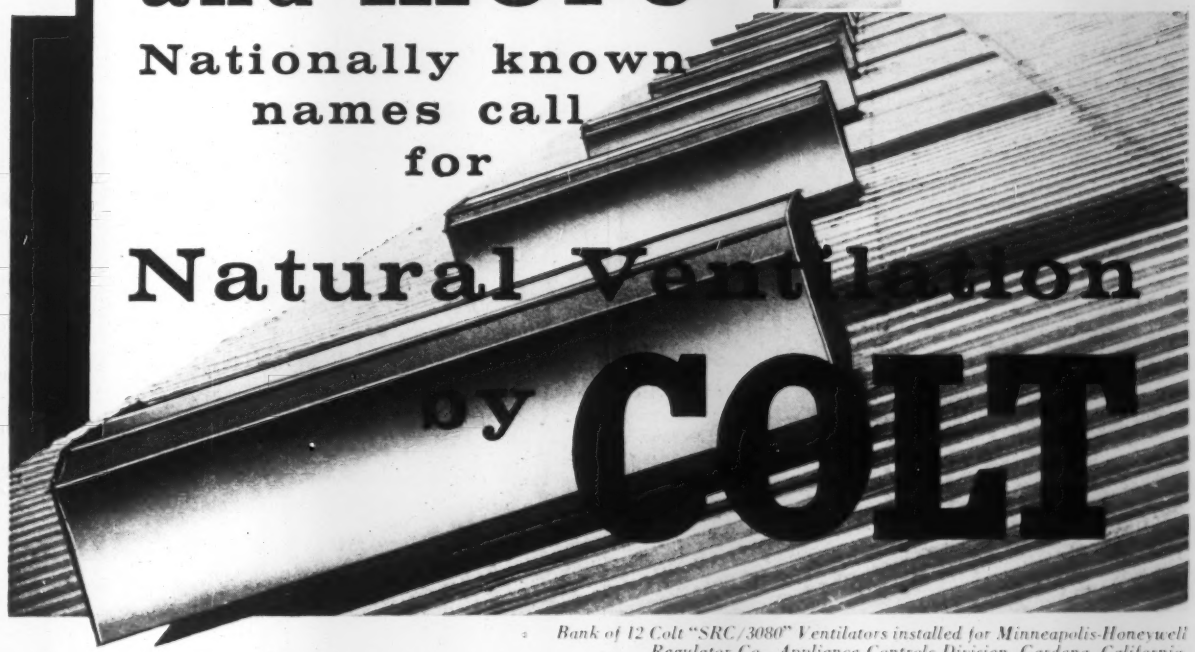


COLT S.R. Series Ventilator (natural gravity —for any type roof)

more and more

Nationally known names call for

Natural Ventilation by COLT



Bank of 12 Colt "SRC/3080" Ventilators installed for Minneapolis-Honeywell Regulator Co., Appliance Controls Division, Gardena, California. Empire Steel Buildings Co., Engineers and Builders, Los Angeles.

- *Accessory Product Company*
- *American Licorice Co.*
- *Cannon Electric Co.*
- *Continental Airlines, Inc.*
- *Desert Ceramics Corporation*
- *Fairchild Semi-Conductor Corp.*
- *Glenn of California*
- *Golden Citrus Juices, Incorporated*
- *Harvey Aluminum*
- *Kaiser Aluminum and Chemical Corp.*
- *Lebanite Products Company*
- *L. A. Stamp & Stationery Co.*
- *Millrich Engineering Corporation*
- *New England Lead Burning Corp.*
- *North American Aviation, Inc.*
- *Pacific Steel Casting Co.*
- *Pioneer Diecasters, Inc.*
- *Pioneer Electronics Corporation*
- *Precision Grinding Co.*
- *Rohr Aircraft*
- *Union Hardware and Metal Company*
- *Zandt Carpet Co.*

Manufacturers across the nation are discovering the advantages of moving air and exhausting excess heat from their plants the economical and efficient COLT way. The revolutionary new COLT SR Series of natural draft ventilators produces maximum positive extraction of excess heat and stale air. This new extra high performance ventilator was developed by COLT to meet the problem of extremes in climate. COLT will save you real money. Send coupon today for complete detailed information.

• **PROVED!** 45,000 installations throughout the world. Improved employee comfort and morale in plants means increased production.

• **LOWER!** COLT'S low profile in keeping with modern architectural standards, blends with the attractive silhouette of newer industrial buildings.

• **LIGHTER!** All aluminum construction. Can be installed in any type of factory roof without additional bracing.

WIDE RANGE OF VENTILATORS TO SUIT EVERY NEED—IN STOCK NOW

SEND COUPON TODAY FOR FREE LITERATURE

Please send, without obligation, items checked:

☐ New, revised TECHNICAL MANUAL describing the Colt System. HPA

☐ "Some Aspects of Fire Prevention in Industrial Buildings", by M. J. Reaney.

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COMPANY _____

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VENTILATION OF AMERICA, INC.
4652 Hollywood Blvd. • Los Angeles 27, California
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Los Angeles 59, Calif.
PLymouth 6-8111

■ Now available with extra-heavy "hex" gripping surface (on most sizes) for fast, easy field use, low-cost Mayco Dielectric Bushings stop damaging electrolysis action before it starts. Made from toughest PLASKON nylon... bright red in color... withstand pressures to 1000 lbs., temperatures to 300° F. Control electrolysis on plumbing, heating and gas applications — wherever dissimilar metals are joined.

Order Mayco Dielectric Bushings from your jobber today... or write:

MAY PRODUCTS, INC. Galesburg, Illinois

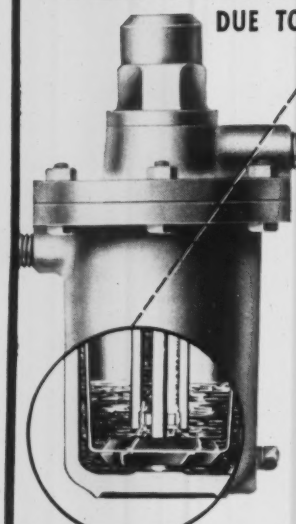
Manufacturers of MAYCO Dielectric Fittings – MAYCO Water Softeners

TRERICE Steam Traps

NEVER LEAK

DUE TO WIRE-DRAWING!

Patented Propeller Rotates Stainless Steel Valve— Assures Long Life



Action of the exclusive rotating valve in Trerice steam traps puts an end to steam leakage problems! With every discharge the valve rotates and seats in a new steam-tight position—wire drawing is eliminated!

LONG LIFE Stainless steel bucket, valve stem and propellers are assembled as one unit—only one moving part in the trap. Guaranteed long-life service.

EASY, LOW-COST MAINTENANCE Trerice steam traps can be inspected easily, quickly, right on the line! No need to disturb high pressure bolts and gaskets. You save all ways—on fuel, labor and downtime!

Write today for Trerice bulletin 1400M containing data on the Trerice rotating valve steam trap

H.O. TRERICE CO. 1420-C W. Lafayette Blvd. Detroit 16, Michigan

WE HEAR THAT

Continued

▶ *KEASBEY & MATTISON CO.* has awarded an $1800 scholarship to Robert W. Egolf. He will study physics at the College of Engineering of Drexel Institute of Technology, Philadelphia.

▶ *FRANKELL MFG. CO.* has moved to a new plant at 862 Newark Ave., Jersey City 6, N. J.

▶ *WOLVERINE TUBE DIV., CALUMET & HECLA, INC.* sponsored seminars on advances in heat transfer design in 10 major cities for engineers from the process industries.

▶ *HENRY F. DEVER*, vice-president of *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, has been awarded an honorary doctor of science degree from Bradford Durfee College of Technology, Fall River, Mass. *J. ERNEST SMITH*, vice president and director of the company's Datamatic Div. has received an honorary doctor of science degree from his alma mater, Jamestown College in North Dakota.

▶ *JOSEPH T. RYERSON & SON, INC.* has added 12 in. diam Schedule 40 and Schedule 80 to its line of rigid, unplasticized PVC pipe.

▶ *CLEAVER-BROOKS CO.* recently concluded its first regional sales managers meeting at its Milwaukee offices.

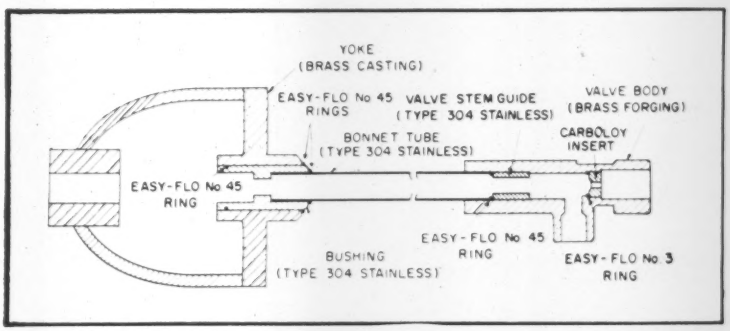
▶ *ACME INDUSTRIES, INC.* has appointed five of its top salesmen of air conditioning and refrigeration systems to a newly formed field sales council in order that the company might exchange constructive comments and viewpoints with its sales force. The men appointed, each of whom will represent 25 similar groups in his area, are: William N. Hart, Michigan; Richard G. Blakeslee, southern California; Marc A. Scheffler, eastern Pennsylvania and southern New Jersey; Marvin H. Potter, Washington, D. C.; Bob Carow, Texas Panhandle.

▶ In addition to acting as distributor for *REYNOLDS METALS CO.* aluminum pipe, *HORACE T. POTTS CO.* will utilize Reynolds' aluminum to manufacture its own line of Schedule 10 and Schedule 40 pipe fittings.

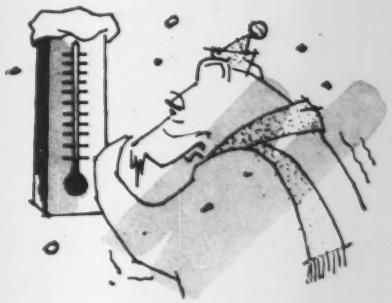
▶ *WATTS REGULATOR CO.* recently held its annual sales meeting in Andover, Mass., which was attended by 60 representatives from the U. S. and Canada. ≠

Don't Worry About Joint Strength At Sub Zero Temperatures . . .

EVEN AT MINUS 300F HANDY & HARMAN SIL-FOS AND EASY-FLO BRAZED JOINTS ARE VERY STRONG



Six-Piece Expansion Valve Assembly For Air Separator Joined In One Operation: Drawing of valve assembly shows locations of 5 preplaced rings of EASY-FLO 3 and EASY-FLO 45.



The need for strong, tight joints for ultra cold service—in rocketry, cold treating and refrigeration of all types—becomes more and more critical.

Recent low temperature tests with Handy & Harman's silver brazing alloys SIL-FOS and EASY-FLO on deoxidized copper lap joints show impressive joint strength.

At minus 321°F, the joint strength (in psi) of EASY-FLO 45 is 30,100 lbs. At the same temperature, the psi of a SIL-FOS brazed joint is 21,900 lbs. These strengths represent the average of four tests with each alloy; HANDY FLUX was used in each test.

A current "sub-zero" example is Air Products, Inc., Allentown, Penn. This company makes an air separator which produces tonnage quantities of oxygen and/or nitrogen for industrial use. The separator's components consist of Type 304 stainless steel, cast bronze, brass, copper, copper bronze and Carboloy. Joint sizes range from less than ¼ inch to 54 inches in diameter. In operation the separator is exposed to temperatures of minus 300°F and pressures approaching 5000 psi. To join this complex assembly, Air Products uses Handy & Harman's EASY-FLO 35, EASY-FLO 3 and EASY-FLO 45 and HANDY FLUX.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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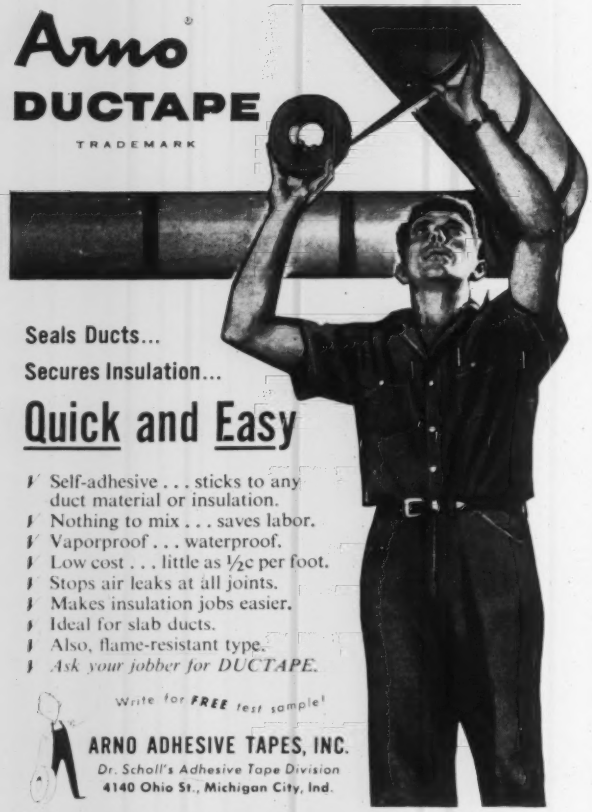

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MEETINGS & CONVENTIONS

1959

AUG. 10-14—*Apprentice Instructor Training Course*, and pipe fitter apprentice contest. Purdue University, Lafayette, Ind. Information: United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U. S. and Canada, United Association Bldg., 901 Massachusetts Ave., N. W., Washington 1, D. C.

SEPT. 13—*American Society for Testing Materials*, Pacific area meeting. Sheraton Palace Hotel, San Francisco. For information contact: American Society for Testing Materials, 1916 Race St., Philadelphia 3.

SEPT. 21-25—*Instrument Society of America*, instrument-automation conference and exhibit, International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

SEPT. 28-*OCT.* 1—*American Welding Society*, fall meeting. Sheraton-Cadillace Hotel, Detroit. Information: American Welding Society, 33 W. 39th St., New York 18.

SEPT. 29-*OCT.* 1—*Western Region Conference of the National Association of Corrosion Engineers*, annual meeting. Bakersfield Inn, Bakersfield, Calif., Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 5-7—*American Gas Association*, annual convention, Conrad Hilton Hotel, Chicago. Information: American Gas Association, 420 Lexington Ave., New York 17.

OCT. 5-8—*Northeast Region Conference of the National Association of Corrosion Engineers*, annual meeting, Lord Baltimore Hotel, Baltimore, Md. Information: National Assocation of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 20-22—*North Central Region Conference of the National Association of Corrosion Engineers*, annual meeting. Cleveland. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

OCT. 27-30—*Insulation Distributor-Contractors National Association, Inc.*, annual convention, Flamingo Hotel, Las Vegas. For information contact: Insulation

MEETINGS & CONVENTIONS

Continued

Distributor-Contractors Association, Inc., 1632 K St., N. W., Washington 6, D. C.

NOV. 1-6—*Insulation Distributor-Contractors National Association, Inc.*, Mid-Pacific conference. Hawaiian Village Hotel, Honolulu. Information: Insulation Distributor-Contractors Association, Inc., 1632 K St., N. W., Washington 6, D. C.

NOV. 2-5—*Air Conditioning and Refrigeration Institute*, 11th exposition. Atlantic City Auditorium, Atlantic City, N. J. Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

NOV. 16-20—*National Association of Corrosion Engineers*, annual general Florida conference and corrosion short course. Key Biscayne Hotel, Miami. Information: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

DEC. 1-4—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Chase Hotel, St. Louis, Mo. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14.

1960

JAN. 25-28—*National Plant Maintenance and Engineering Show*. Convention Hall, Philadelphia, Pa. For information contact: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 1-4—*2nd Southwest Heating and Air Conditioning Exposition*. Dallas. Under auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting, also in Dallas. Meetings to be held in the Baker and Adolphus Hotels; exposition to be held in Memorial Auditorium. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York 13.

APRIL 25-29—*American Welding Society*, annual meeting and exposition. Los Angeles. Information: American Welding Society, 33 W. 39th St., New York.

APRIL 27-30—*Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference*, Shrine Exposition Hall, Los Angeles. Information: Western Air Conditioning Industries Association, 3443 S. Hill St., Los Angeles 7. ‡

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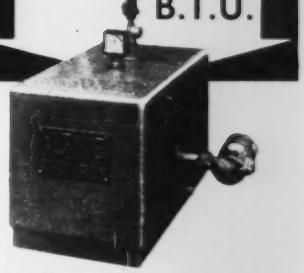

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NEW BOOKS & REPORTS...

ROOM AIR-CONDITIONERS. NEMA Standards Publication CN1-1958. National Electrical Manufacturers Association, 155 E. 44th St., New York 17. 30 cents.

TECHNICAL BOOKS SPONSORED BY THE UNITED STATES ATOMIC ENERGY COMMISSION. Listing of 112 volumes in print or preparation. United States Atomic Energy Commission, Washington 25, D. C.

Room Thermostats, DC 3-1959. National Electrical Manufacturers Assn., 155 E. 44th St., New York 17. 40 cents.

Asbestos: Its Industrial Applications by D. V. Rosato. 214 pp. Reinhold Publishing Corp., 430 Park Ave., New York 22. $5.75.

Training Manual of Arc Welding. 50 pp. American Welding Society, 33 W. 39th St., New York 18. $3.00.

Gas Transmission and Distribution Piping Systems. 88 pp. American Society of Mechanical Engineers, 29 W. 39th St., New York 18. ≠

Obituary

Jack F. Croasdale

JACK F. CROASDALE, vice president of Revere Copper and Brass, Inc. and executive head of its Baltimore (Md.) Div., died suddenly on June 19, 1959, while in Pittsburgh on business.

Mr. Croasdale, 54, had been with Revere since September 1927, with the exception of the period from May 1929 to March 1933, when he was connected with Williams & Co. in Pittsburgh.

He was named district manager of Revere's Pittsburgh office in March 1933, where he served until February 1946, when he was promoted to the post of assistant sales manager of the Baltimore Div. In October of that year, he was named sales manager and in September 1958 he was elected a vice president of Revere and appointed executive head of the Baltimore Division.

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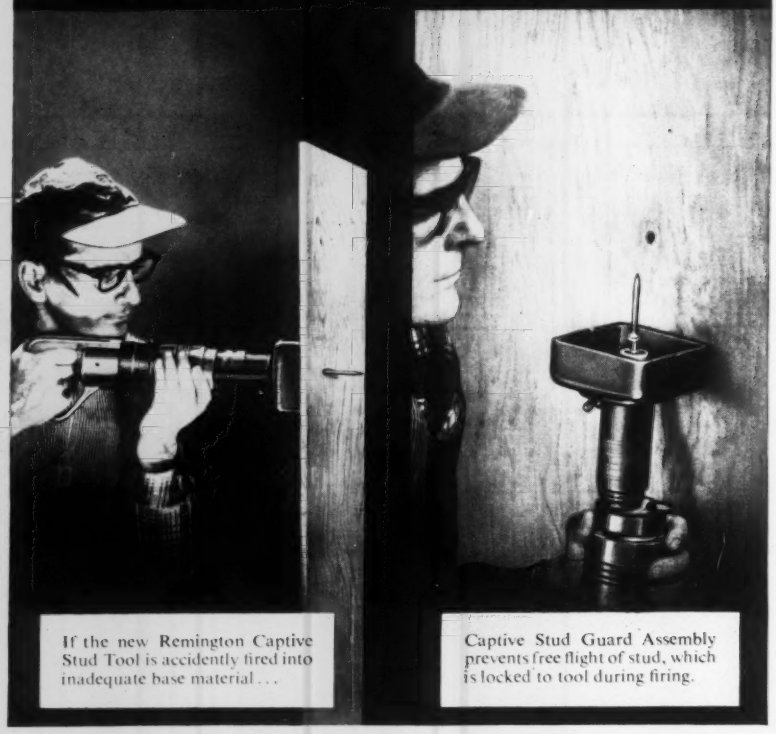

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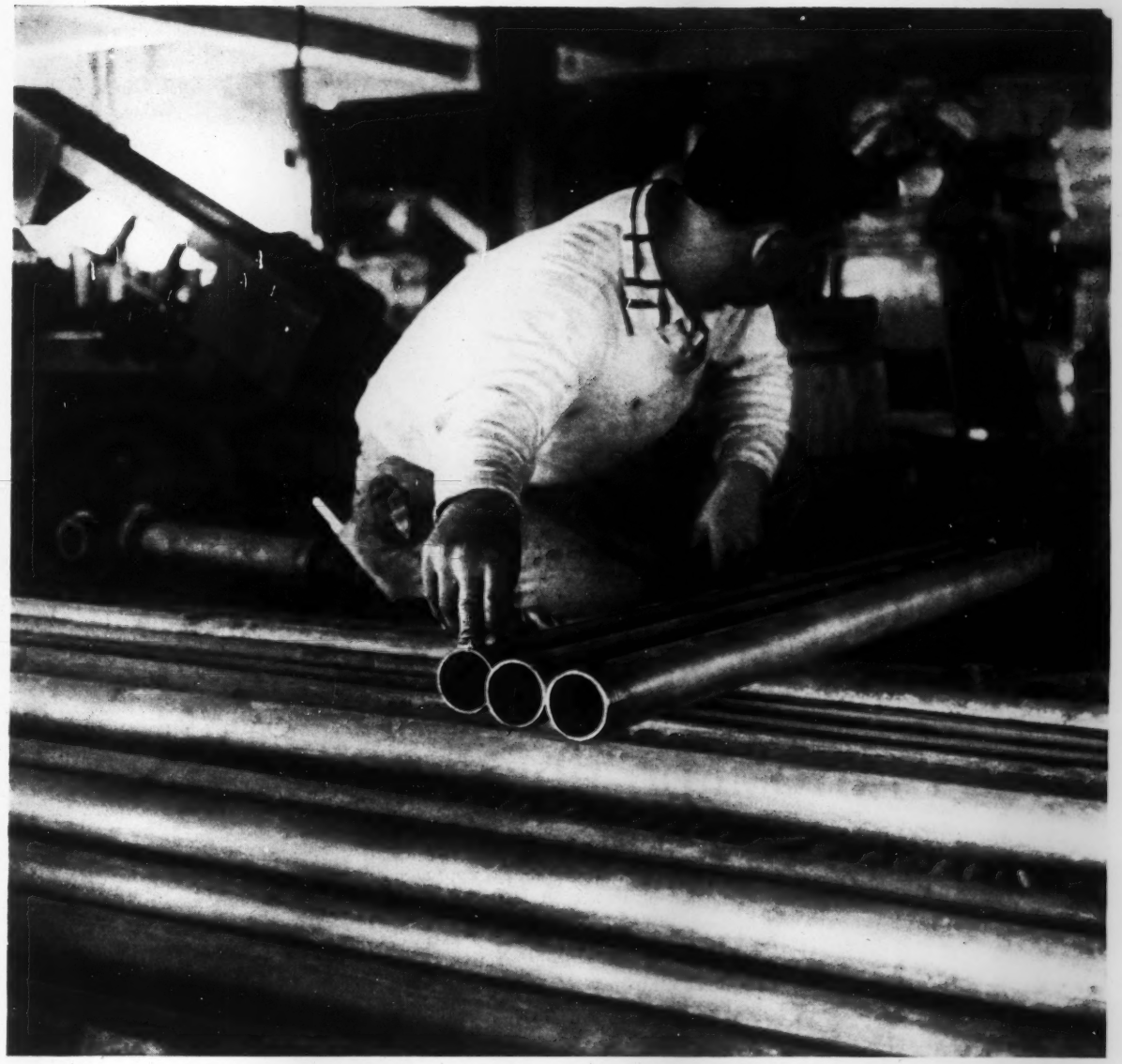

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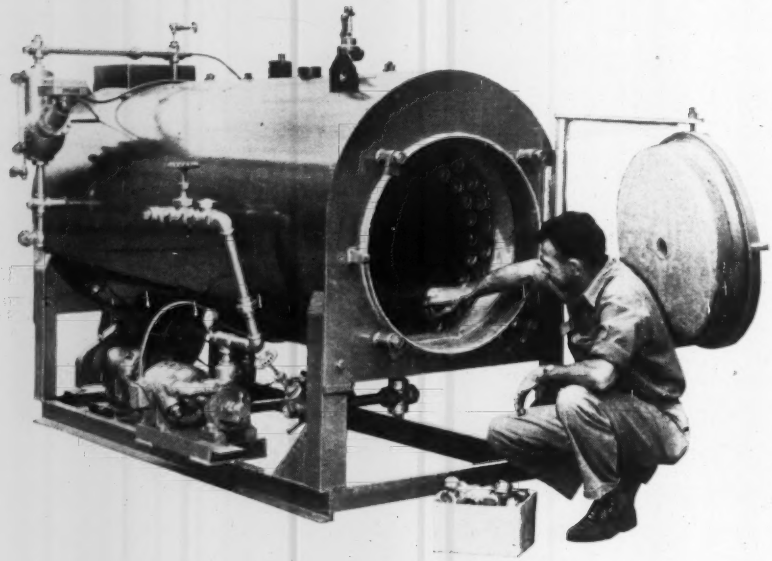

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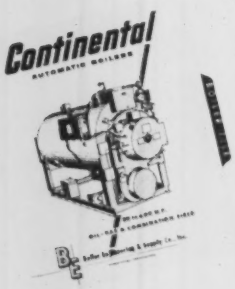

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Easy to apply FOAMGLAS Stay-Dry Pipe Insulation covers 18,000 lineal feet of hot and cold pipe lines in the new Norton Building, Seattle, Washington. An additional 30,000 feet of FOAMGLAS insulation was used throughout the building for refrigerated surfaces, pump coverings and as backing for Spandrelite curtain wall panels on the building's exterior. Architect: Bindon & Wright. Consulting Architects: Skidmore, Owings & Merrill. Mechanical Engineers: Bouillon, Griffith & Christofferson.

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won't let condensation form on these building service lines

Condensed moisture on building service piping can drip down and ruin costly interior finishes and furnishings. Consulting Engineers, Bouillon, Griffith and Christofferson found an excellent, low-cost solution to this problem in Pittsburgh Corning's new FOAMGLAS Stay-Dry Pipe Insulation . . . 18,000 lineal feet of it to insulate heating and air conditioning lines in the Norton Building, Seattle, Washington.

FOAMGLAS is a natural vapor barrier . . . composed entirely of sealed glass cells. And the air inside those cells is the world's best insulator. FOAMGLAS now is available in low-cost prefabricated 24″ pipe covering segments with a kraft-foil laminate jacket for a tough protective coating and attractive white outer finish. It can be painted with water base paints.

This unique combination of benefits . . . gives you cost-saving features not found in other commercial, dual-temperature pipe insulations: Easy to apply. No additional moisture seals or cut-offs required. No vapor barrier jacket required. High compressive strength. Easy to cut and shape. Cannot burn. Waterproof. Insulating value never varies. Moisture absorption is no problem. And it is vermin-proof.

It is available in 1″ and 1½″ nominal thicknesses . . . for all lines from ½″ copper tubing through 6″ I.P.S. for service from +35°F to +350°F. For more information on new FOAMGLAS Stay-Dry Pipe Insulation, write to: Pittsburgh Corning Corporation, Dept. HP-89, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.

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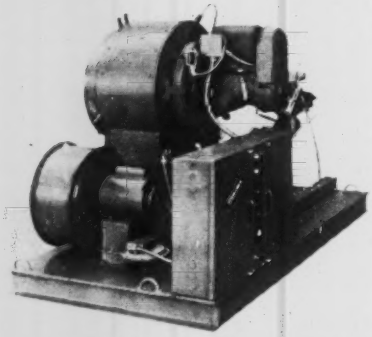

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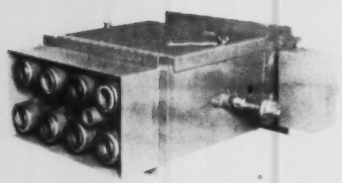

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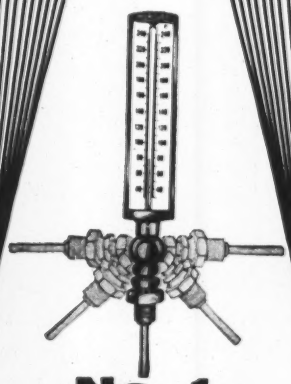

No. 1 SPACE STRETCHER

"Inner space" problems are sometimes more baffling to engineers, architects and contractors than those concerned with "outer space."

That needed inch or two amid the usual maze of pipe, conduit, tube and cable is worth its size in gold!

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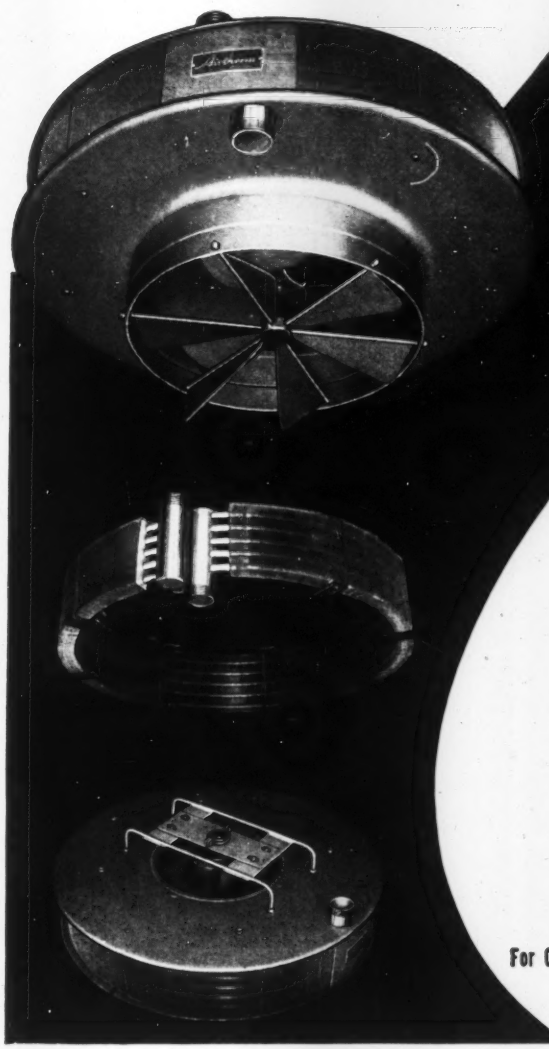

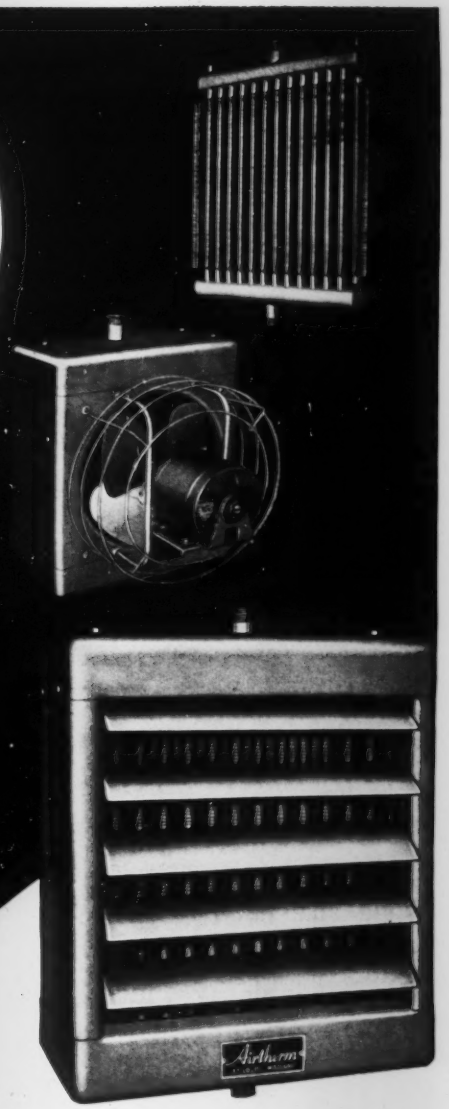

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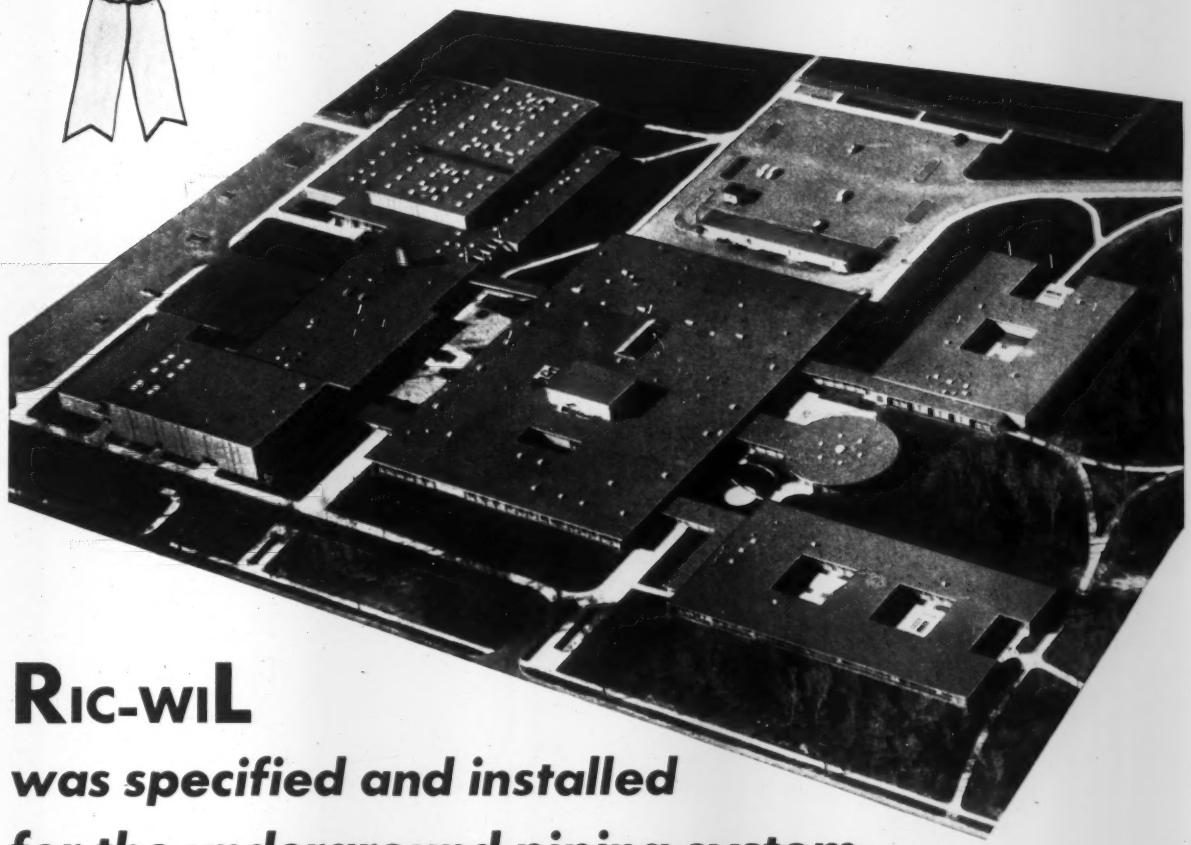
at Award Winning Linton High School...



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Baltimore, Maryland

Pittsburgh Fiber Glass Pipe Insulation is easily slipped on the pipe. Insulation will be hand-stapled-in place, eliminating metal strap fasteners.

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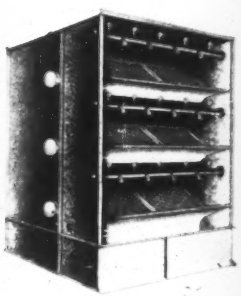
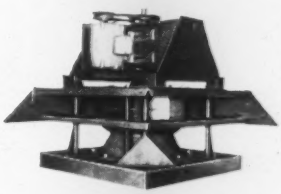


REQUEST CATALOG 405 covering the Clarage Capillary Air Washer. Equipped with capillary cells. Three arrangements available. Capacities 4,400 to 132,000 CFM.



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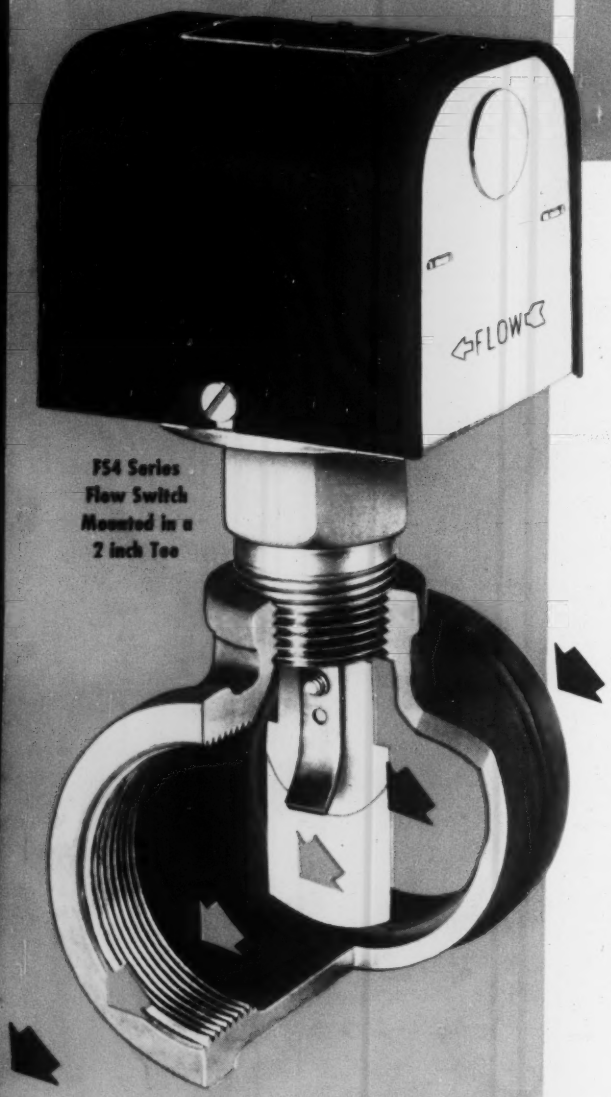
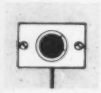


FS4 Series Flow Switch Mounted in a 2 inch Tee

Do you know how many jobs these switches can do?

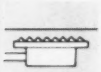
Look at the FS4 Series Flow Switch illustrated here. What you see is a compact, well-built switch that either makes or breaks a circuit (as required) when liquid flows or stops flowing. Yet in this versatile device you have both the most economical way and the most positive way of starting or stopping a signal, an alarm, a motor, a metering device—anything electrically operated. Just to highlight a few uses:—



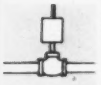
to actuate a signal light—signal an attendant to make the right moves in operating valves, pumps and the like—signal him when flow stops in a water cooled compressor, water cooled bearing and so on.

to sound an alarm—when flow stops in a process system or in any water cooled devices.

to start or stop motors—start pumps in sequence in multiple stage flow systems; start standby pumps; stop automatically controlled units if cooling water system fails; stop compressors in cooling systems when flow stops. These are *control* functions, and almost endless.



to start or stop automatic burners—start a booster heater when water draw occurs; stop burner if flow is improperly retarded; make sure of circulation in a boiler before burner is permitted to start.



to actuate metering devices—open valve in chemical feeder line; start mixing in secondary line whenever flow starts in primary line.

Think it over! Some of these uses may suggest some related problem the FS4 can solve for you right now. Notice the facts about its construction and service range opposite.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

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It covers design, construction, electrical ratings and dimensions. Points out many typical applications.

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McDonnell quality throughout:

Compact switch with positive snap action. Removable cover and two knockouts for easy wiring. Phosphor bronze sylphon seals assembly leak-tight from line. Paddle made in segments to fit any pipe from 1" through 3". FS4 series, illustrated, is for maximum working pressure 100 psi; maximum temperature, 300° F., in types as follows:

FS4 Closes with flow, opens with no flow.

FS4R Opens with flow, closes with no flow.

FS4-3 Single pole, double throw switch. Opens and closes two separate circuits with flow. Closes and opens same two circuits with no flow.

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● Model E-2 available for larger pipe sizes and pressures to 150 psi.